

COLUMBIA LIBRARIES OFFSITE
HEALTH SCIENCES RESTRICTED



HR02228718

RECAP

SERIAL

Columbia University
in the City of New York
College of Physicians and Surgeons
Library



OCT 16 1943



Digitized by the Internet Archive
in 2010 with funding from
Columbia University Libraries

Fifteenth Annual Report

OF THE

State Board of Health

OF THE

STATE OF OHIO

FOR THE

YEAR ENDING OCTOBER 31, 1900.



FRED. J. HEER, STATE PRINTER.
COLUMBUS, OHIO.

LETTER OF TRANSMITTAL.

OHIO STATE BOARD OF HEALTH,
OFFICE OF THE SECRETARY,
COLUMBUS, O., August 1, 1901.

To His Excellency, GEO. K. NASH, Governor of Ohio:

SIR:—In accordance with Section 8 of an "Act to create and establish a State Board of Health," the accompanying report is herewith submitted for the year ending October 31, 1900.

Respectfully,

C. O. PROBST,
Secretary.

JUN 23 1902 JUN 23 1902

MEMBERS OF THE OHIO STATE BOARD OF HEALTH.

*JOSIAH HARTZELL, PH. D., <i>President</i> , Canton.....	December, 1900
WM. T. GEMMILL, M. D., <i>Vice President</i> , Forest.....	December, 1901
BYRON STANTON, M. D., Cincinnati.....	December, 1902
J. C. CROSSLAND, M. D., Zanesville.....	December, 1903
WM. T. MILLER, M. D., Cleveland.....	December, 1904
FRANK WARNER, M. D., Columbus.....	December, 1905
W. C. CHAPMAN, M. D., Toledo.....	December, 1906
C. O. PROBST, M. D., <i>Secretary</i> .	

*Reappointed, term expires December, 1907.

GENERAL REPORT.

This is the fifteenth annual report of the State Board of Health. While the report is properly for the year ending October 31, 1900, it has been found desirable that parts of it, as mortality statistics, reports of local health authorities, and the work of the laboratory, should be for the calendar year.

It would be advisable to amend the law requiring the Board to make an annual report so as to have the entire report for the calendar year.

PERSONNEL OF THE BOARD.

There have been no changes in the personnel of the Board since the last report.

MEETINGS.

Three meetings were held during the year. A report of the proceedings will be found further on.

At the January meeting, as usual, a conference of the State and local boards of health was held. Fully three hundred delegates were present, and the meeting was in every respect a successful one.

SMALLPOX.

As predicted in the last report, smallpox has continued to prevail in many localities in the state. The type of the disease has not changed, and there is reason to expect that it will continue to maintain its comparatively benign character.

The Board has done its utmost to stay the march of this epidemic, but with indifferent success. The disease has been promptly stamped out in one community only to reappear in another. Many patients have gone through with the disease without medical attendance; in numerous other cases the physician has failed to recognize the disease as smallpox. It has had little terror for the people generally, and vaccination has therefore been neglected. Smallpox is prevalent throughout the United States, and many of our outbreaks have been traceable to other states. These and other causes are responsible for the continuance of the disease.

The Secretary being unable to respond to the many calls for assistance in smallpox outbreaks, the Board appointed a number of Medical Inspectors in different parts of the state to be sent to nearby places when the local authorities needed assistance. These gentlemen were carefully

selected because of their experience in dealing with smallpox, and their special fitness for the delicate position of "referee" in cases "where doctors disagree." The Board wishes to publicly thank each and all of them for the prompt assistance invariably accorded upon demand.

Following is a list of the Medical Inspectors:

Dr. B. F. Lyle, Price Hill, Cincinnati.

Dr. C. F. Hoover, Cleveland.

Dr. L. F. Laudick, Lima.

Dr. J. F. Marchand, Canton.

Dr. E. C. Brush, Zanesville.

Dr. J. Andrew Heinlein, Bridgeport.

Dr. G. A. Collamore, Toledo.

Dr. W. L. Buechner, Youngstown.

*Dr. James Johnston, Gallipolis.

Dr. J. H. Moninger, Columbus.

The Board, through its Secretary, a member of the Board, or a Medical Inspector, visited 81 localities during the year on account of smallpox. Difficulties in deciding the diagnosis occasioned most of these visits.

Vaccination has been far from general, even in communities in which smallpox has been more or less prevalent. There remain a large number of persons susceptible to smallpox, from their failure to be vaccinated or revaccinated, and there is every reason to fear that the epidemic will continue during the coming year.

There were 1896 cases of smallpox with 29 deaths reported to the Board during the twelve months ended October 31, 1899. For the year ended October 31, 1900, there were 2286 cases and 24 deaths. During the calendar year of 1900, 3229 cases and 44 deaths were reported.

CASES AND DEATHS OF SMALLPOX REPORTED TO THE STATE BOARD OF HEALTH,
NOVEMBER 1—DECEMBER 31, 1899.

County.	Place.	Cases.	Deaths.
Allen	Lima	1	...
Belmont	Warren Township	1	...
Butler	Hamilton	4	1
Clark	Springfield	4	...
Clermont	Loveland	2	...
Clinton	Adams Township	1	...
Columbiana	East Liverpool	1	...
	Salem	1	...
Crawford	Galion	3	...

* Dr. Johnston having been removed by death, Dr. Fred. A. Cromley, of Gallipolis, was appointed as his successor.

CASES AND DEATHS OF SMALLPOX REPORTED—Continued.

County.	Place.	Cases.	Deaths.
Cuyahoga	Cleveland	25	...
	Glenville	1	...
Delaware	Chagrin Falls.....	1	...
	Concord Township.....	13	...
	Delaware	35	1
	Delaware Township.....	15	...
	Radnor Township.....	3	...
Fairfield	Sunbury	2	...
	Lancaster	4	...
Franklin	Columbus	6	...
Greene	Jamestown	1	...
	Xenia	1	...
Hamilton	Cincinnati	2	...
	Green Township.....	1	...
Hancock	Findlay	1	...
Lucas	Toledo	5	...
Madison	Canaan Township.....	1	...
	Darby Township.....	3	...
	Plain City.....	32	...
Ottawa	Danbury Township.....	9	...
Stark	Canton	1	...
Trumbull	Bristol Township.....	1	...
	Niles	26	...
Union	Jerome Township.....	2	...
	Unionville Center.....	1	...
Total — Counties .....21	Places	34	2

CASES AND DEATHS OF SMALLPOX REPORTED—Continued.

JANUARY 1—DECEMBER 31, 1900.

County.	Place.	Cases.	Deaths.
Adams	Bratton Township.....	16	...
	Peebles	16	...
	West Union.....	1	...
Allen	Auglaize Township.....	6	...
	Beaver Dam	11	...
	Shawnee Township.....	7	...
Ashtabula	Ashtabula	33	...
	Conneaut	43	...
	Conneaut Township	5	...
	Kingsville Township.....	5	...
Athens	Saybrook Township	1	...
	Athens	4	...
	Nelsonville	12	...
Auglaize	Trimble Township.....	2	...
	Cridersville	9	...
	Duchouquet Township.....	1	...

CASES AND DEATHS OF SMALLPOX REPORTED—Continued.

County.	Place.	Cases.	Deaths.
Belmont	Bridgeport	1	....
	Martin's Ferry.....	6	....
Brown	Higginsport	3	....
	Huntington Township.....	1	....
	Lewis Township.....	1	1
Butler	Fairfield Township.....	1	....
	Hamilton	1	....
	Middletown	2	....
Clark	Harmony Township	6	....
	Springfield	2	....
	Springfield Township	4	....
Clermont	Franklin Township	2	....
	Loveland	1	....
Clinton	Adams Township	1	....
	Green Township	1	....
	New Vienna	1	....
	Vernon Township	3	....
Columbiana	Wellsville	19	2
Coshocton	Clark Township	2	....
Crawford	Bucyrus	2	....
Cuyahoga	Bedford Township.....	9	....
	Berea	5	....
	Brooklyn Township.....	2	....
	Chagrin Falls Township.....	1	....
	Cleveland	993	16
	Dover Township	5	....
	East Cleveland	3	....
	Euclid Township	1	....
	Glenville	4	....
	Lakewood	3	....
	Mayfield Township	29	....
	Newburgh	82	3
	Parma Township	1	....
	Rockport	3	....
	Royalton Township	7	....
	Warrensville Township	2	....
Darke	Allen Township	5	....
	Greenville	4	....
	Greenville Township	2	....
	Jackson Township	1	....
	Washington Township	4	....
Defiance	Highland Township	8	....
	Richland Township	5	....
Delaware	Delaware	24	....
	Girls' Industrial Home.....	20	....
	Radnor Township	1	....
Erie	Margaretta Township	3	....
Franklin	Columbus	40	....
Fulton	Wauseon	2	....
Gallia	Clay Township.....	10	....
	Gallipolis	34	....
	Green Township	16	....
	Greenfield Township.....	1	....
	Huntington Township	1	....
	Ohio Township.....	4	....
	Springfield Township.....	32	....
Geauga	Burton	4	....
	Chester Township.....	8	....

CASES AND DEATHS OF SMALLPOX REPORTED—Continued.

County.	Place.	Cases.	Deaths.
Greene	Cedarville	20	2
	Miami Township	2	1
Hamilton	Anderson Township	2	...
	Cincinnati	210	7
	Hyde Park	1	...
Hancock	Miami Township	1	...
	Findlay	3	...
Hardin	Alger	51	1
	Cessna Township	9	...
	Kenton	6	...
	Liberty Township	1	...
	Lynn Township	3	...
	Marion Township	19	...
	McDonald Township	21	...
	McGuffey	41	...
	Roundhead Township	43	...
	Silver Creek	2	...
	Taylor Creek Township	20	...
	Holgate	15	...
Henry	Marion Township	38	...
	Pleasant Township	75	3
Hocking	Murray City	20	...
	Ward Township	4	...
Huron	Bellevue	11	...
	Greenwich Township	1	...
Jackson	Coal Township	6	...
	Milton Township	10	...
	Washington Township	1	...
	Wellston	85	...
Knox	Fredericktown	11	...
Lake	Fairport	1	...
	Painesville	1	...
	Willoughby Township	1	1
Lawrence	Elizabeth Township	2	...
	Hanging Rock	7	...
	Ironton	4	...
	Symmes Township	1	...
Logan	Upper Township	6	...
	Rush Creek Township	3	...
Licking	Newark	2	...
	Utica	3	...
	Washington Township	11	1
Lorain	Amherst Township	2	...
	Eaton Township	1	...
	Elyria	29	...
	Lorain	73	2
Lucas	North Amherst	1	...
	Toledo	4	...
Madison	Canaan Township	12	...
	Darby Township	8	...
	Monroe Township	1	...
	Plain City	40	...
Mahoning	Youngstown	14	...
Marion	Marion	2	...
Medina	Brunswick Township	8	...
	Lodi	12	...
	Medina	4	...

CASES AND DEATHS OF SMALLPOX REPORTED — Continued.

County.	Place.	Cases.	Deaths.
Mercer	Granville Township	27	...
	Recovery Township	10	...
Montgomery	Dayton	16	...
	Germantown	2	...
	Jackson Township	2	...
	Jefferson Township	1	...
	Harrison Township	2	...
	Perry Township	2	...
Morrow	Cardington	1	...
	Chesterville	4	...
	South Bloomfield Township	4	...
	Sparta	1	...
Paulding	Benton Township	116	1
	Blue Creek Township	5	...
	Crane Township	5	...
	Harrison Township	9	...
	Haviland	2	...
	Payne	65	...
Perry	Junction City	1	...
Pike	Camp Creek Township	27	...
	Waverly	2	...
Portage	Kent	6	1
Putnam	Continental	1	...
	Palmer Township	28	...
Richland	Jefferson Township	1	...
	Shelby	3	...
Ross	Kingston	1	...
Scioto	Brush Creek Township	7	...
	Morgan Township	44	...
	Porter Township	2	...
	Portsmouth	17	...
Stark	Beach City	1	...
	Canton	10	...
	Jackson Township	15	1
	Marlboro Township	1	...
	Plain Township	2	...
	Sugar Creek Township	1	...
Summit	Akron	1	...
	Boston Township	10	...
	Norton Township	6	...
Trumbull	Bazetta Township	1	1
	Bristol Township	7	...
	Champion Township	4	...
	Kinsman Township	1	...
	Mecca Township	3	...
	Mineral Ridge	1	1
	Niles	27	...
Tuscarawas	Dennison	3	...
Union	Jerome Township	2	...
Van Wert	Harrison Township	28	...
	Tully Township	75	...
	Union Township	1	...
	Van Wert	1	...
Vinton	Elk Township	1	...
	Madison Township	4	...
Washington	Marietta	2	...
	Muskingum Township	1	...

CASES AND DEATHS OF SMALLPOX REPORTED — Concluded.

County.	Place.	Cases.	Deaths.
Wayne	Morris Township	4	....
	Salt Creek Township.....	3	....
	West Salem	2	....
Williams	Florence Township	12	....
	Northwest Township	7	....
	Springfield Township	1	....
Total — Counties .....63	Stryker	1	....
	Places	195	3,229 44

WATER SUPPLIES AND SEWERAGE.

Plans for water supplies for the following places were brought before the Board for approval:

Conneaut, Zanesville, Piqua, Sebring, Dayton, Batavia, Bucyrus, Canton, Versailles, Bellevue, Fort Recovery, Painesville, Leipsic, Cuyahoga Falls, Waynesville, Lynchburg, Leetonia, Gallipolis and McConelsville.

These were all approved except those for Painesville. The Board voted to disapprove the plans for increasing the water supply of Painesville because the present system of collecting the water was considered unsatisfactory, and the proposed addition was merely an extension of the old system. The authorities of Painesville were advised to secure the services of a competent engineer to look over the ground and prepare plans for a more efficient and reliable system of filtration.

The following places submitted for approval plans for sewerage or sewage purification works:

Toledo, Districts Nos. 27, 34 and 35; Mansfield, Lakewood, Marion, Greenville, Canal Dover, Xenia, Gordon Park, Cleveland, Conneaut, Lima, Kenton, Delaware, Barberton, Evanston, South Brooklyn and Bowling Green.

These were all approved with the exception of Sewer District No. 27 of Toledo. The Board voted to disapprove modifications in plans to carry the sewers for District No. 27 to a ravine in Valley street, providing temporarily for their outlet at that point.

PURIFICATION OF PUBLIC WATER SUPPLIES.

The necessity of purification of public water supplies is now attracting much attention in this country. Pittsburg, Cincinnati and Louisville have purification works under way. New Orleans has decided to

purify its supply, and the best methods for doing this are being studied with the aid of an experimental plant. Plans have been made for purifying the water supply of Philadelphia and that of Washington, D. C., and New York City is seriously considering the necessity for purifying its supply. There would seem to be a strong wave of public sentiment in favor of purer water supplies, a sentiment to be strengthened and encouraged in every way possible.

The investigation of the streams of Ohio which the Board has been conducting for several years indicates that few of these afford a safe or satisfactory water supply in their natural condition. Aside from the contamination of most of our streams by the sewage and waste products of cities and villages along their banks, most of them, for a part of the year, carry such an amount of suspended matters — mostly mud — as to render them highly undesirable for domestic purposes. Mark Twain is credited with saying that the inhabitants along the Missouri and lower Mississippi rivers were so accustomed to drinking muddy water, that they could not relish clear water, and insisted upon adding a little mud to it. However this may have been, the sentiment of our people has undergone a marked change in this respect. The enormous increase in the sale of table waters, which are clear and are therefore accepted as pure, is a costly protest against the condition of most of our public water supplies.

Roily waters are not necessarily dangerous to health. There is even reason to believe that some of our streams are less dangerous when turbid than when clear, as the rains that bring in the mud may dilute the impurities which are entering the stream at all times. Fortunately the methods which will remove suspended matters, the mud, from water, will at the same time remove to a greater or less degree the disease producing bacteria which the water may contain. For some waters the suspended matters can be largely removed by simple sedimentation, by holding the water in reservoirs for two or three days. This is true where the suspended matters are coarse and of a greater specific gravity than water. In settling, these suspended matters carry down with them a considerable number of the bacteria present in the water. This method of purification is not suitable for waters receiving sewage, as such waters must, at times, contain many disease producing bacteria, and sedimentation could not be depended upon to remove all such bacteria.

Some of our rivers, and this is notably true of the Ohio river, contain for long periods suspended matters — clay — which are in the form of exceedingly fine particles, smaller than bacteria, and of about the same specific gravity as water. These particles do not subside, and the water remains turbid, no matter how long it is kept standing.

If it is assumed that all of the public water supplies in Ohio of surface origin should be purified, the following cities and villages would be included in this list:

From Lake Erie: Conneaut, Ashtabula, Cleveland, East Cleveland, Glenville, Lakewood, Lorain, Sandusky, Lakeside, and Port Clinton, with a total population of 452,192. Conneaut, Lorain and Lakeside have already introduced filters.

For the Ohio river: East Liverpool, Wellsville, Toronto, Steubenville, Mingo Junction, Martin's Ferry, Bridgeport, Bellaire, Marietta, Pomeroy, Middleport, Ironton, Portsmouth, New Richmond, Cincinnati, Evanston, Winton Place, College Hill and Hyde Park, with a total population of 449,167. Mingo Junction, Pomeroy and Middleport are filtering their supplies, and Cincinnati is building filtration works.

From interior streams: Piqua, Cambridge, Dennison, Uhrichsville, Zanesville, Bucyrus, Upper Sandusky, Defiance, Findlay, Napoleon, Toledo, Alliance, Fostoria, Lisbon, Monroeville, Norwalk, Oberlin, Warren, Wellston, and Youngstown, with a total population of 316,724. Dennison, Uhrichsville and Warren are supplied with filtered water. This gives a combined population of 1,218,083 supplied with surface water, only a small part of which is purified. This does not include several cities and villages having an auxiliary supply of surface origin.

Cleveland, the largest city in the list, is improving its water supply by extending its intake, and by the construction of an intercepting sewer that will deliver all sewage to the lake ten miles distant from the water intake. This will undoubtedly greatly improve the condition of their supply, but it remains to be seen whether the water, in time of storms, will not continue to be muddy, and whether it will be beyond danger of sewage contamination. There are other places in the list just given where the water at present may possibly be classed as usable, but where there is an increasing pollution of the source of supply that will make purification necessary.

It is doubtful whether any of the public water supplies taken from the Ohio river are safe, while the excessive, and to a considerable extent unremovable, turbidity of the water for long periods makes it a very undesirable supply.

Many of our cities must, undoubtedly, soon turn their attention to water purification. Fortunately a long experience in water purification in Europe, and to a less extent in the United States, gives us assurances of success in dealing with this question, although different conditions of our streams have to be taken into consideration.

The European filters are simply beds of sand two or three feet thick, resting upon a layer of gravel. The water is slowly passed through them, the suspended matters and bacteria being held back on the surface of the beds. Most all the suspended matter and from 98 to 99 per cent. of the bacteria may be removed in this manner.

Waters containing very fine particles of clay, as the Ohio river waters at Cincinnati, cannot be economically purified in this manner. The clay particles are too small to be arrested at the surface of the filter

bed; they penetrate the filter and soon clog it. This difficulty has been overcome by mixing with the water before it goes to the filter bed something that will act as a coagulant, and will collect these fine particles into larger masses, and carry them to the bottom just as white of egg clears coffee. Water thus treated may be filtered through an ordinary European sand-bed filter, but the ingenious Yankee has found a quicker and, under some conditions, a better way of doing it. By adding alum — one to two grains to a gallon usually — to water and allowing it to stand a short time, much of the suspended matter may be removed, and the water can be rapidly filtered through a small sand filter, which can be cleaned by back-washing as often as necessary. This form of filtration, the so-called mechanical filter, is in operation in Ohio at Lorain, Dennison and Ulrichsville, Conneaut and Batavia, and a modified form of the mechanical filter will be used at Cincinnati.

While every effort should be made to keep our streams as free from contamination as possible, nevertheless communities that rely upon them to furnish domestic water supplies will be obliged to purify the water to render it safe from water-borne bacteria and satisfactory in appearance.

LABORATORY.

The workings of the laboratory are dealt with under a separate heading. It will be seen that a large share of its operations has been devoted to examinations of the two Miami rivers. Another year will be required to complete the investigation of the condition of sources of public water supplies in Ohio. During the coming year a study will be made of the public water supplies taken from Lake Erie and the Ohio river.

On account of the exigencies of this special line of work no effort has been made to extend the use of the laboratory in other directions. All requests for examinations of suspected cases of diphtheria and tuberculosis have been granted. A dog suspected to have had rabies was examined, with positive results. A child bitten by this dog afterwards died of hydrophobia.

A number of wells suspected to have caused typhoid fever were examined. When the special examination of rivers is completed there will be an opportunity for much valuable work along lines which at present are somewhat neglected.

LOCAL BOARDS OF HEALTH.

While on the whole local boards of health are increasing in efficiency, it is doubtful whether they have kept fully in advance of public opinion, which is demanding a much stricter enforcement of sanitary regulations than was possible ten years ago.

Some changes are urgently needed in the laws governing boards of health. In the first place there should be longer tenure of office and

better compensation for the health officer. Except in the large cities this official is still very much under-paid. In too many places politics control or influence this appointment. There is, in this country, no school for the education of health officers. It is only after some years of actual experience that a health officer may become really efficient. His duties are highly complex; and he requires a diversity of knowledge that practice only can give him. What folly, when a community has found a competent man, and has trained him as health officer (at considerable cost to itself) for it to allow him to be removed because he differs in politics from the incoming administration. And yet this is constantly occurring.

The rural districts suffer from the lack of a proper enforcement of the health laws. The township trustees, who constitute a board of health for their township, in the main are anxious to discharge this duty. They have had and have, however, little opportunity to become acquainted with sanitary matters. New men are constantly coming into office, so that there is not much chance for learning by experience. The law authorizes the trustees to appoint a township health officer, and about one-half the townships have done so. Where good men have been selected health matters are going fairly well in the township. It would be well to require each township, as is the case with cities and villages, to appoint a health officer; and their salaries should be made commensurate with their duties.

The various operations of the Board during the year, the reports of local boards of health, and statistics of mortality, will be found under appropriate headings.

SECRETARY'S REPORT AND MINUTES OF BOARD MEETINGS.

JANUARY MEETING.

A regular meeting of the State Board of Health was held at the office of the Secretary, in Columbus, January 24th, 1900.

All members were present except Dr. Miller. Mr. Hartzell presided.

A committee from Greenville, consisting of the Mayor, City Clerk, City Engineer and members of council, presented plans for a sewerage system, and requested their approval.

The Mayor and City Solicitor of Mansfield presented outlines of a bill they proposed to present to the General Assembly, giving certain powers to that city to enable it to put in sewage purification and garbage disposal works. They requested the Board's approval of the bill.

The Health Officer of Piqua presented plans for a water supply for that city to be obtained from deep wells on an island in the Miami river, and the following communication:

COLUMBUS, O., January 24, 1900.

To the Ohio State Board of Health:

GENTLEMEN;—The Water Works Trustees of the city of Piqua request your approval of obtaining a public water supply from wells upon an island in the Miami river, situated between Piqua and Rossville, as shown upon map.

Yours truly,

(Signed) F. E. KITZMILLER.

Health Officer of Piqua.

The Health Officer of Hamilton requested the Board to approve an issue of bonds by that city, the funds to be used for paying expenses incurred in suppressing an outbreak of smallpox, and for improving the city's sanitary condition.

The City Engineer and some members of the city council of Toledo presented a request for the approval of certain modifications in the plans for Sewer District No. 27 in that city. They also presented the following communication:

COLUMBUS, O., January 24, 1900.

To the Honorable, The State Board of Health, Columbus, Ohio:

GENTLEMEN:—We, the undersigned citizens of Toledo, Ohio, hereby petition your Honorable Body to set in motion the necessary legislation to the end that the water main in said city may be extended to Millard avenue, in that portion of said city known as Ironville, believing that the same is a necessity from a sanitary view and also for fire protection, as presented this 24th day of January, 1900.

(Signed) W. F. BROWN, C. C. E.,

DR. F. N. GARAND,

N. S. BINGHAM,

S. TRUDEAU,

JAMES HALES,

J. C. MACBROWN,

J. C. MEISSNER.

The President and several members of the Ohio Funeral Directors' Association presented the outlines of a proposed bill to regulate the practice of embalming.

Mr. Snow, C. E., presented plans for a sewage purification plant for Marion.

It was voted to consider these various questions in executive session.

On motion of Dr. Stanton it was voted to approve the plans for a water supply for Piqua, as presented by Dr. Kitzmiller, the health officer of Piqua.

A resolution by Dr. Gemmill was adopted, appointing the Secretary as the delegate from and representative of the Board at the International Congress of Hygiene, to be held in Paris in August, 1900.

On motion the Board adjourned until 9 A. M. of the following day.

SECOND SESSION.

January 25th, 1900. 9 A. M.

The Board reassembled pursuant to adjournment. All members present at the former meeting were there.

On motion of Dr. Crossland, Dr. Chapman was appointed a committee to investigate and report upon proposed plans for Sewer District No. 27 for the city of Toledo.

On motion of Dr. Chapman it was voted to recommend the extension of the water supply of Toledo to Ironville.

The question of proposed legislation for the city of Mansfield being taken up for consideration, it was voted, on motion of Dr. Crossland, that the Secretary be instructed to inform the authorities of that city that the Board deemed it inexpedient to endorse special legislation.

On motion of Dr. Warner the Secretary was instructed to secure a certificate of the expenditures of the health department of Hamilton in combating smallpox.

On motion of Dr. Stanton it was voted to approve the plans for a sewerage system for Greenville, provided that the sewage should be purified in a manner satisfactory to the State Board of Health within a period not exceeding five years from date of approval.

Dr. Crossland and the Secretary reported upon changes to be made in the public water supply of Cambridge.

On motion of Dr. Crossland it was voted to approve the proposed changes in the water supply of Cambridge.

Dr. Crossland reported upon plans for a private sewer to be constructed in the village of Caldwell, and recommended that the plans be approved.

On motion it was voted to approve said plans.

On motion of Dr. Stanton the question of proposed legislation to regulate preparation of dead bodies for shipment, was referred to the Secretary and Dr. Warner.

On motion the Board adjourned to meet on the same date after the evening meeting of the State and Local Boards of Health.

THIRD SESSION.

January 25th, 1900. 10 P. M.

Members present as before.

Mr. Martin, Engineer of Zanesville, presented plans for additional sewerage for that city.

Mr. Harned, Clerk of the Board of Health of Xenia township, Greene county, requested the Board to investigate a nuisance arising from the sewage of the Ohio Soldiers and Sailors' Orphans' Home.

On motion of Dr. Warner, Dr. Stanton, with the Engineer, was appointed a committee to investigate and report upon this complaint.

The health officer and prosecuting attorney of Hamilton presented the following statement, and requested the Board to approve the issue of bonds to the amount of \$2,000, to pay such expenses:

COLUMBUS, O., January 25, 1900.

To the Honorable, The State Board of Health of Ohio:

GENTLEMEN:—Replying to your request for estimate cost of measures taken and to be taken to prevent the spread of smallpox in Hamilton, will say, we have carefully gone over the affairs and find that we have spent so far about as follows:

For special guarding, night and day.....	\$200 00
For coal, groceries, bedding, etc. to indigents in quarantine.....	91 00
For physicians attending indigents in quarantine.....	400 00
For burial, two indigents dying in quarantine.....	100 00
For incidental costs to health department.....	50 00
For cleaning and disinfecting quarantined houses and burning rubbish	25 00

Making a total of.....\$866 00

This will about cover expenses already incurred so far as I can ascertain at this time.

Now as the parts of the city in which these cases have occurred are now and have been for some time in a very poor sanitary condition (especially the streets); and as we had smallpox infection occurring in a school girl where we were unable to find the source of contagion, it is our intention to use the balance of this amount in improving the sanitary condition of these districts as much as possible; and for the expense of quarantining any other cases should they occur before we get any more money in the sanitary fund.

Respectfully submitted,

A. L. SMEDLEY,
Health Officer of Hamilton, O.

On motion of Dr. Chapman it was voted to grant this request.

The Secretary presented a request from the Board of Health of Sidney for the State Board of Health to examine and report upon the sanitary condition of that city, with special reference to the matter of sewerage.

On motion of Dr. Stanton it was voted to appoint a committee to investigate and report. The Chair appointed Dr. Warner as this committee.

The minutes of the meeting of the Board held October 18, 1899, were read and, on motion of Dr. Stanton, were approved.

The following communication from the Engineer of Zanesville was read:

To the President and Members of the Ohio State Board of Health:

GENTLEMEN:—Herewith, a map of the city of Zanesville, a tracing of the U. S. Government Engineer's survey of Slagoe run aqueduct at the Zanesville locks of the Muskingum river canal, and two profiles, are submitted to you for your consideration in connection with the following requests on the part of the Sewer Committee of the city council of the city of Zanesville:

1. May the proposed sewer in Ninth street be built down the hollow of Slagoe run and through the U. S. Government aqueduct arch to the Muskingum river, as shown on blue plat, without allowing Slagoe run to flow through any part of the sewer?

2. May said sewer be built, as in the foregoing proposition, but by an enlargement at the run, allowing Slagoe run to empty its waters through it?

3. In the event of a negative reply to the two preceding propositions, may the sewer be built down to the canning factory and thence along to line of a natural water-way over the bank to the Muskingum river?

4. Might not the sewer be built down the run to the aqueduct arch and thence along the east lock wall, but about 40 feet east from said wall to a point on the bank of the Muskingum river that would be clear to the steamboat landing?

Respectfully submitted, in behalf of the Sewer Committee of the city council of the city of Zanesville, Ohio, by

C. V. MARTIN,

Engineer in charge of work.

On motion of Dr. Stanton it was voted to recommend propositions 1 and 3 of those presented by the Engineer.

On motion of Dr. Stanton it was voted to approve plans for a public water supply for the village of McConnellsville to be obtained from deep wells located near the juncture of Beach and Jefferson streets, said plans having already been approved by mail vote.

On motion of Dr. Warner it was voted to approve plans for a water supply for the city of Greenville to be obtained from wells located a few hundred feet from Greenville creek, said plans having already been approved by a mail vote.

On motion of Dr. Chapman the plans for sewage purification and garbage disposal for the city of Marion were approved.

On motion of Dr. Warner it was voted to approve plans for a water supply for the city of Troy, to be obtained from driven wells along the side of the water works property bordering on the C. H. & D. Railroad, said plans having been previously approved by mail vote.

On motion of Dr. Crossland it was voted to approve plans for filters to improve the water supply of the city of Conneaut, said plans having been previously approved by mail vote.

On motion of Dr. Warner the action of the Board in approving by a mail vote plans for a public water supply for the city of Piqua, said plans having been submitted December 8th, 1899, was rescinded in consideration of the subsequent action of the Board in approving a modification of the plans as presented by the health officer of Piqua, January 24th, 1900.

On motion of Dr. Gemmill it was voted to approve plans for a new water supply for the city of Zanesville, to be obtained from a number of drilled wells on the west side of the Muskingum river opposite the present water works pumping station, said plans having been previously approved by the Board by a mail vote.

On motion of Dr. Crossland it was voted to approve a public water supply for the village of Sebring, to be obtained from a deep artesian well near the pottery on the south side of the P. Ft. W. & C. Railroad, said plans having been previously approved by a mail vote.

The question of approving plans for sewer districts Nos. 34 and 35 of the city of Toledo, the plans having been previously approved by mail vote, was taken up for consideration, and, upon motion, said plans were approved.

On motion of Dr. Chapman it was voted to approve the plans for a system of sewage and garbage disposal for the city of Mansfield, said plans having been previously approved by a mail vote.

On motion of Dr. Stanton it was voted to appoint Mr. B. H. Flynn as Engineer.

It was voted to appoint a Committee on Legislation.

The President named, as members of this committee, Drs. Chapman, Warner and Probst.

Dr. Crossland presented a bill for regulating the cutting and sale of ice.

On motion of Dr. Warner the bill was approved and the Secretary was instructed to secure its introduction before the General Assembly.

The Secretary was also instructed to prepare and have introduced a bill removing the limit to the number of meetings the Board could hold in any one year.

It was voted to take a recess subject to the call of the President.

Attest:

C. O. PROBST,
Secretary.

QUARTERLY REPORT OF THE SECRETARY.

January Meeting, 1900.

Mr President:—I beg leave to submit the following quarterly report:

On October 24th, at the request of the council of Perrysburg I visited that village to look over plans which had been partially prepared, for the construction of a sewer. The plans provided for an outlet main sewer

discharging into the Maumee river within less than ten miles above the point where Toledo takes its water supply from the river.

After examining the plans and going over the route of the sewer, I outlined to the committee of Council the past policy of the Board in regard to approving the turning of crude sewage into streams used for public water supplies, and advised them to refer their question to a competent sanitary engineer, with the expectation of having to provide a satisfactory system of sewage purification.

On December 8th, I was again called to Perrysburg, this time by the board of health, to advise them as to the course to be pursued in abating a nuisance. The nuisance was caused by the overflow from a cess-pool of a much patronized saloon into a sewer which had been constructed to carry off cellar drainage and storm water from one street. There was no way of flushing the sewer, and the odors coming from two untrapped catch basins were the cause of general complaint.

I advised the board of health to prohibit the discharging of all cess-pools, privies, etc., into this sewer, and gave instructions for the necessary legal steps to be taken.

November 8th, I went to Springfield, by request of the health officer, to confer with him in regard to measures to be enforced to prevent further spread of smallpox in that city.

November 11th, by request of the board of health, I went to Delaware to examine some cases suspected to be smallpox. I learned that a student from Erie county had come to Delaware early in September. A few days later he was taken ill and was seen by a physician of Delaware. This physician informed me that the student told him at the time that he had been exposed, in Erie county, to a disease that some of the physicians called chickenpox and others called smallpox. He decided that the student had chickenpox, but advised him to keep to the room he occupied, which was in a private family with whom he was boarding, and not to receive visitors.

Other cases soon appeared in this family, from which the disease was spread to many other families in Delaware and vicinity.

In one family just outside of Delaware I found eight cases of smallpox in a family of ten. Two of the patients, adults, had been sick for weeks and plainly showed that they had had moderately severe cases of smallpox. Five or six of the patients had a history of having had chickenpox some years ago, and of the ten members of the family the only two to escape were the mother and her mother, both of whom had been vaccinated, although many years ago. Every fact pointed to smallpox, and is difficult to understand how a mistake in diagnosis could have been made.

Other cases which I saw in the city of Delaware were undoubtedly smallpox.

I met the health officer and the board of health and the measures to be enforced to control the disease were thoroughly discussed. I also gave instructions to the township board of health in reference to cases in the township.

On January 12th the health officer reported that all cases had been dismissed from quarantine. There was one death, a young man in the family where the disease first appeared, and 55 cases in Delaware and vicinity.

From Delaware the disease was carried to Plain City by a young girl who visited relatives who were having smallpox, and who lived in the country near Delaware.

I was called to Plain City by the health officer December 8th, and examined a number of cases, which I pronounced smallpox. The disease had been prevailing for some weeks, and had spread to the surrounding townships. The first case, a school girl, had, as usual, been mistaken for chickenpox. The health officer furnished me a list of twenty-six persons who had or had had the disease.

I met the board of health, health officer and superintendent of schools, and measures for preventing the spread of the disease were discussed.

The health officer reports January 22, that 14 patients are still under quarantine. The total number of cases in Plain City and vicinity was 79. There were no deaths.

The disease was carried into Indiana from Delaware, by a man named Eager, who was taken sick while on this way from Delaware to Harlan, Indiana, where he lives. His wife and grandson, who were with him, also had the disease. It spread from this family to others at that place.

Smallpox was also carried to Galion from Delaware. A man, his wife and child, who had been living near Delaware, visited the wife's parents, who were having smallpox at the time. The three came to Galion, and were taken sick shortly after their arrival.

These cases are of interest as regards the payment of expenses incurred in their quarantine and treatment. As the patients had not lived in Galion long enough to give them a residence, when taken ill, the health authorities of Galion expect to require Delaware county to bear this expense.

I went there January 9th, by request of the board of health, as they wished to be advised as to disinfection, and especially the destruction of infected articles.

The questions of sewage disposal, and of the possible pollution of the public water supply, were discussed at a meeting of the board of health which was called. A resolution was adopted, requesting the State Board of Health to investigate and report upon the condition of their public water supply, which is furnished by a private company. The resolution is given in the following communication from the health officer, which I received since my visit there :

GALION, OHIO, January 10, 1900.

C. O. Probst, M. D., Columbus, Ohio:

DEAR DOCTOR:—At a special meeting of the board of health, held January 9, 1900, they passed a resolution as follows: Resolved, that the health officer request the State Board of Health to make an analysis and report of the Galion Water Works Company's water.

Respectfully,

H. H. HARTMAN.

November 22d I was called to Niles by the health officer to examine cases of suspected smallpox, the diagnosis being in dispute. I saw cases in four families, and had no hesitancy in pronouncing them to be smallpox. The disease was introduced by a man who had come from Philadelphia and who was visiting relatives in Niles. He had a mild attack of smallpox, and started the disease in the family he was visiting, from which it spread to other families.

The total number of cases reported to date in Niles is 30. No deaths.

Since the last meeting of the Board smallpox has been reported in forty-nine places, with 437 cases and 3 deaths.

In virtue of the authority conferred upon me at the last meeting to secure medical assistance in case of epidemics of contagious diseases, I have arranged for a number of Medical Inspectors in various parts of the State. By having a number the territory to be covered by any one will be much less than if but one or two inspectors were employed, which means a saving in both time and money. I have been very careful in selecting the men for this work, and have not yet completed the list. The financial arrangement in each case has been that their expenses, and a per diem to be fixed by the board, would be paid. The per diem, I hope will be fixed at this meeting.

The following Medical Inspectors have been selected so far: Columbus, Dr. J. H. Moninger. Dr. Moninger had entire charge of the smallpox cases in this city last year, and gained a large experience in diagnosing cases of the peculiar epidemic we are now having, and in handling the disease. He has been sent to the following places: October 26, Lancaster; October 27th, Cedarville and Jamestown; January 5th Cedarville, and January 6th, South Bloomfield, Morrow county; in all of which places he found cases of smallpox.

Dr. C. F. Hoover has been selected for Cleveland. Dr. Hoover is regarded as a specialist in diagnosis, and was highly recommended by Dr. Miller. Dr. Hoover visited Lakeside December 2nd, where he found cases of smallpox.

Dr. B. F. Lyle has been selected for Cincinnati, with the understanding, however, that Dr. Stanton would be first called upon and would go when possible; Dr. Stanton having kindly consented to this arrangement. I would like, at this meeting, to make a similar arrangement with other members of the board, as regards investigations in their immediate vicinity, if any are willing to undertake this somewhat arduous duty.

Dr. Lyle is the physician in charge of the smallpox hospital of Cincinnati, and has had a very considerable experience with smallpox. He investigated suspected cases of smallpox near Ft. Ancient in Warren county, on December 27th. They proved to be chickenpox.

Dr. G. A. Collamore was selected for Toledo. He was health officer for many years of Toledo, and has had much experience with smallpox.

Dr. L. F. Laudick was selected for Lima. He is now health officer of Lima, has had smallpox to deal with, and is an excellent executive officer.

Dr. J. A. Heinlein was appointed for Bridgeport. Dr. Heinlein was health officer of Bridgeport during their epidemic a few years ago, and is in every way a capable physician.

Dr. J. F. Marchand has been selected for Canton. Dr. Marchand has been health officer of Canton for a number of years, and has had experience in the diagnosis and prevention of smallpox.

This makes seven who have been selected so far. The first three named are the only ones who have been called upon as yet. I wish to select a man for Portsmouth, Gallipolis or Pomeroy, possibly Marietta, and one for Youngstown.

I trust there will not be much work for these Medical Inspectors to do. It is my intention to do as much of it myself as can be done without too much sacrifice of the work of the office.

November 12th I made an investigation of the sanitary condition of the High School building of Findlay, the investigation having been made at the request of two hundred and three petitioners, residents of that city. I was informed some weeks ago that a new High School building will be constructed there at once.

The report of my investigation will be presented later on.

On December 14th, in company with the President of the Board, I visited Wooster. It will be remembered that the Board, at a meeting held in Cleveland in June, 1898, refused to grant permission to Wooster to continue to use water from Apple creek. Water was continuously pumped from this creek during the summer, however, and was being pumped from it on the day of our visit.

A meeting was held in the office of the Mayor, who presided. There were present representatives of the Council, Water Works Trustees, Board of Health, the Health Officer, Superintendent of Water Works, and Professor W. J. Bennett, of Wooster University, who had for some time, been making frequent chemical and bacteriological examinations of the public water supply, and of a number of wells. The Health Officer reports seven deaths from typhoid fever during the past few months. The number of cases was not known. Two cases occurred in the family of the President of the Board of Water Works Trustees, Dr. Beers, who has been actively endeavoring for years to secure a pure water supply for Wooster. So far as known all the cases of typhoid occurred among users

of well water. In explanation it may be said that the public supply is so objectionable in taste, odor and appearance, that few persons drink it. But the unsatisfactory public supply is clearly responsible for the typhoid fever by driving the people to the use of polluted well water.

The situation was discussed from all sides. The advice of your representatives was to secure the services of a competent sanitary engineer and have him report upon the best method for obtaining a satisfactory supply of water. We left with the understanding that this proposition would be taken up at an early meeting of council.

Seventy-four physicians accepted the invitation to present the matter of Tuberculosis in Animals at the Farmer's Institutes. Many letters have been received expressing an interest in this work.

The field work of the investigation of the Muskingum river has been completed, and the data is being put into shape for the annual report.

There have been received at the laboratory, during the quarter, 160 samples, and these have received a total of 317 analyses. This represents the work of but 55 days, as the bacteriologist was on the road 23 days out of the 78 week-days occurring in the quarter.

The average cost per sample has been \$4.81, or \$2.42 per examination.

The building commission for the State House Addition has definitely assigned to the Board three office rooms on the ground floor, and four rooms for Laboratory, on the top floor.

The following plans for water works and sewerage, presented since the last meeting of the Board, and which were voted upon by letter, require the *viva voce* vote of the Board.

Water Supply: Greenville, Troy, Conneaut (filters), Zanesville, Batavia, and Sebring.

Sewerage: McConnelsville, Lakewood disapproved, and amended plans later approved; Toledo Districts No. 34 and No. 35, approved; District No. 27, deferred until this meeting.

Sewerage and Sewage Disposal: Mansfield.

In addition to visits made by the Secretary the following have been made by members of the Board:

Dr. Crossland, Cambridge, water supply.

Dr. Stanton, Sabina, nuisance.

Dr. Kahle, Findlay, smallpox.

Mr. Hartzell, Sebring, water supply.

Dr. Stanton, Batavia, water supply.

All arrangements have been completed for the meeting of the State and local boards of health, to begin tomorrow.

I would respectfully recommend that Mr. B. H. Flynn be appointed the official engineer of the Board.

Respectfully submitted,

C. O. PROBST,
Secretary.

MAY MEETING.

A meeting of the State Board of Health was held in Columbus, at the office of the Secretary, on May 8th, 1900. All members except Dr. Miller and Mr. Hartzell were present.

Dr. Gemmill, Vice-President, presided.

Mr. Wm. McE. Weldon, City Solicitor of Mansfield, appeared before the Board and explained the provisions of a recent Act of Legislature which would enable the city of Mansfield to put in works to dispose of sewage and garbage provided the State Board of Health declared it to be necessary. He requested the Board to pass a resolution, which would be in harmony with the action already taken by the Board, declaring these sanitary improvements to be necessary.

The City Solicitor, members of the Committee of Council on Sewerage, of Lima, and an Engineer appointed by the Council, presented plans for additional sewerage for the city of Lima.

Mr. N. O. Goldsmith, Vice-President of the Wefugo Company of Cincinnati, presented plans for filtering the proposed water supply of the village of Batavia.

The Mayor, City Solicitor, City Engineer, and Consulting Engineer of Xenia, presented plans for a sewerage system, including purification works, for the city of Xenia.

Mr. F. P. Kahler, Superintendent of the Water Works of Bucyrus, presented plans for a new water supply for that city.

Mr. B. F. Hewitt, City Engineer of Conneaut, presented plans for constructing a sewer in District No. 3 in that city.

On motion of Dr. Stanton the Board went into executive session.

Dr. Chapman reported verbally upon the changes in plans for Sewer District No. 27 for the city of Toledo; changes which the Board at its meeting in January, 1900, was requested to approve.

Dr. Chapman recommended that the proposed changes in plans be disapproved.

Dr. Stanton moved that the proposed modifications and changes in plans for Sewer District No. 27 for the city of Toledo be disapproved.

The motion was duly seconded and carried.

On motion of Dr. Stanton it was voted to proceed to the election of officers.

Dr. Stanton nominated Dr. Gemmill for President. The motion was duly seconded and a ballot being taken, Dr. Gemmill was declared elected President, the term of office to begin at the regular meeting to be held in October, 1900.

Dr. Gemmill nominated Dr. Stanton for Vice-President. A ballot resulted in the election of Dr. Stanton for Vice-President, and he was declared elected, to take his seat at the next regular October meeting.

The Secretary, on motion of Dr. Stanton, was authorized to employ an assistant chemist.

It was then voted to take a recess until 9 a. m., May 9th, 1900.

SECOND SESSION.

May 9th, 1900, 9 A. M.

Members present as before.

The minutes of the January meeting for 1900 were read and approved.

The Secretary presented his quarterly report which, on motion of Dr. Warner, was approved.

The Secretary stated that a number of propositions which had been voted upon by mail should now be reaffirmed by a *viva voce* vote.

Upon motion of Dr. Stanton it was voted to disapprove plans for a sewerage system for Lakewood with purification of dry weather flow only, which were disapproved by mail vote December 21, 1899.

On motion of Dr. Chapman it was voted to approve amended plans for Lakewood, providing for purification of all the sewage, but permitting the temporary use of a ditch to carry sewage to the lake, previously approved by mail vote.

On motion of Dr. Warner it was voted to approve plans for a sanitary system of sewers for a part of the village of Canal Dover, with an outlet to the Tuscarawas river, with the provision that the sewage be purified whenever required by the State Board of Health, previously approved by mail vote.

On motion of Dr. Stanton it was voted to approve plans to enlarge and extend the sewerage system of South Brooklyn, to be used for the present for storm water and cellar drainage only, upon the filing in the office of a map showing the location of the sewer in the various streets and its outlet, previously approved by mail upon this condition.

On motion of Dr. Crossland it was voted to approve a new water supply for the Ohio Hospital for Epileptics at Gallipolis, to be obtained from deep wells, previously approved by mail vote.

On motion of Dr. Chapman it was voted to approve plans for changes and extensions of the water supply for Dayton, previously approved by mail vote.

On motion of Dr. Warner it was voted to approve the outlet of a sewer for Plain City, said outlet being into Big Darby creek, previously approved by mail vote.

The following resolution relative to Mansfield was read by the Secretary, and upon motion of Dr. Warner, was adopted.

Resolved by the State Board of Health of the State of Ohio: That in our opinion it is necessary for the city of Mansfield, Ohio, to adopt measures without further delay for the relief and improvement of its sanitary condition by the proper disposal of its sewage and garbage; and that this resolution is now passed in

order to put in proper form the action which this Board has heretofore taken, informally, with the same object in view."

On motion of Dr. Chapman it was voted to approve the plans presented for a sewerage system with disposal works, for the city of Xenia.

The Secretary was instructed to write to the Board of Trustees of the Ohio Soldiers' and Sailors' Orphans' Home, and respectfully suggest that the feasibility of making use of the sewerage system of Xenia for the removal of the sewage of that institution be considered.

On motion of Dr. Stanton it was voted to approve the plans for changes and extensions of the sewerage system of Lima, as presented to the Board, provided that all sewage now being, or to hereafter be, discharged into the Ottawa river shall be purified in a manner satisfactory to the State Board of Health before the proposed sewers are brought into use.

On motion of Dr. Chapman it was voted to approve plans presented for filtering the proposed water supply for Batavia, provided the Wefugo Company gave a satisfactory guarantee of "bacterial reduction averaging ninety-seven per cent. when the number of bacteria in the raw or unfiltered water is in excess of seven thousand per cubic centimeter, and that the number of bacteria in the filtered water shall not average more than two hundred per cubic centimeter when the number of bacteria in the raw or unfiltered water is less than seven thousand per cubic centimeter."

On motion of Dr. Warner it was voted to approve the plans presented for a new water supply for the city of Bucyrus, provided the water should be purified in a manner satisfactory to the State Board of Health whenever, in the opinion of said Board, this should become necessary.

The Secretary reported that the time limit had expired for several cities whose plans for sewerage had been approved upon the condition that sewage purification works should be constructed within a certain specified time. He recommended that an investigation be made in each case with the view of determining whether present conditions as regards stream pollution, if any, were such as to require the immediate introduction of sewage purification works.

On motion of Dr. Stanton it was voted to have the engineer instructed to visit the various places mentioned and report.

The Secretary presented communications from the health officer and superintendent of water works at Salem, and from Mr. Strawn, city engineer of that place, relative to the introduction of a clay pipe conduit to carry water from some deep wells through the city to the main pumping station.

The communications were ordered to be filed.

The Secretary reported the prevalence of typhoid fever at Mingo Junction, suspected to be due to the pollution of the public water supply, and recommended that an investigation be made.

On motion of Dr. Stanton it was voted to send a committee, with the engineer if necessary, to investigate the sanitary condition of Mingo Junction, with special reference to the prevalence of typhoid fever.

The Chair appointed Dr. Crossland as this committee.

The request of the superintendent of the water works of the city of Canton to approve an additional supply of water to be obtained from deep wells one and one-half miles north of the city, was taken up for consideration, and on motion of Dr. Chapman it was voted to approve the said additional supply.

Dr. Crossland moved that the Secretary be instructed to request the president of the senate to sign the ice bill, which passed both branches of Legislature, but which, by an oversight, failed to receive the signature of the president of the senate.

The motion was carried.

The Secretary presented a report, prepared by the Engineer, upon the water supply proposed for the village of Versailles.

On motion of Dr. Stanton it was voted to disapprove the proposed supply, and to recommend that a search for a supply of ground water be made at a place where it would not be in danger of pollution.

The Secretary reported that the water works trustees of Bellevue were preparing to make some changes in the public water supply, and that a petition had been received asking that the matter be investigated.

On motion of Dr. Chapman it was voted to send a committee to to Bellevue to investigate and report.

The chair appointed Dr. Chapman as this committee.

A communication was presented by the Secretary from Mr. George W. Schachleiter, of Ironton, relative to the alleged unsanitary condition of passenger cars belonging to the Norfolk and Western Railway Co.

On motion of Dr. Stanton the communication was received and ordered filed.

The Secretary presented plans for a sewer in Gordon Park, Cleveland, with the following communication from the Board of Park Commissioners:

CLEVELAND, O., April 27, 1900.

C. O. Probst, M. D., Secretary State Board of Health, Columbus, Ohio:

DEAR SIR:—Your letter to Chief Engineer C. W. Pratt, Jr., then Chief Engineer of the Board of Park Commissioners, of date April 5, 1900, in reference to the right to construct and maintain a public sewer in Gordon Park Avenue, with an outlet into Lake Erie, in this city, has been turned over to me for answer. As was also the letter of Mr. Pratt of April 4, to which yours is an answer. I understand from your letter that it is probable that the request of the city would be granted on condition that a clause similar to that embraced in the permit to the Board of June 8, 1898, which clause (quoting from your letter) is as follows: "It

being distinctly understood and agreed that when the proposed intercepting sewer is built by the city of Cleveland according to plans already approved by the State Board of Health, all house sewage will be directed from Gordon Park avenue sewer into the said intercepting sewer." I am instructed by resolution of the Board, adopted at a meeting on the 25th inst., to insert a similar clause in the present request, and ask that you grant the request for such public sewer with this agreement therein, which is hereby made a part of this request.

I understand from Mr. Pratt's letter that he sent a plan to you of the proposed sewer with his letter of April 4.

An early reply will very greatly oblige the Board of Park Commissioners.

Yours very respectfully,

(Signed) GEO. J. HOFFMAN,
Secretary.

It was voted, on motion of Dr. Stanton, to approve the plans for said sewer upon the condition of "It being distinctly understood and agreed that when the proposed intercepting sewer is built by the city of Cleveland according to plans already approved by the State Board of Health, all house sewage will be directed from Gordon Park avenue sewer into the said intercepting sewer."

Dr. Crossland moved, and it was voted to approve plans presented for Sewer District No. 3 for the city of Conneaut, provided "that sewage purification works for the proper purification of the sewage of Conneaut shall be constructed whenever this shall be deemed necessary by the State Board of Health."

No further business presenting, the Board adjourned to meet at the call of the President.

Attest:

C. O. PROBST,
Secretary.

QUARTERLY REPORT OF THE SECRETARY.

May Meeting, 1900.

MR. PRESIDENT:—Your Secretary begs leave to submit the following quarterly report:

Two bills were prepared in accordance with instructions. One to remove the limit to the number of meetings the Board may hold in any one year, the other to regulate the cutting and sale of ice. The former bill, introduced in the House by Dr. Love of Erie, became a law without opposition. The ice bill was introduced in the House by Mr. Comings, of Lorain, was amended in the House by Mr. McKibben, of Ashtabula, so as to apply only to ice used or sold for domestic purposes, and passed in that shape. In the Senate it remained in the hands of the committee, in spite of efforts to have it reported back, until three or four days prior to adjournment. It came up for passage on the day of adjournment, and passed with but one dissenting vote. The records of the House and Senate show that the bill passed, and that it

was signed by the Speaker of the House and President of the Senate. The bills itself, as referred to the Secretary of State for publication, shows only the signature of the Speaker of the House.

The laws enacted by the last General Assembly have not yet been printed. Several acts have more or less bearing upon health matters. They will be published in our Bulletin as soon as copies can be obtained.

A special act for Columbus creates a Board of Sewer Commissioners which will have full control of the plans for the construction of trunk sewers and a purification plant.

A meeting between your committee — Dr. Warner and the Secretary — and a committee of the Ohio Funeral Directors' Association was held at the office of the Secretary and a bill to regulate the preparation of bodies to be transported was agreed upon. This bill was introduced in the Senate but did not reach a vote.

The Board was granted an appropriation of \$16,500 for the year ending February 15th, 1901, and of \$17,000 for the year ending February 15, 1902.

Smallpox has continued to prevail in various parts of the state. The number and location of all cases reported have been published in the "Ohio Sanitary Bulletin." The total number of cases reported from January 1st, 1900, to date, May 8th, is 1056, and of this number but 1.2 percent. have died, so that it may be seen that the mild character of the disease continues.

February 22nd, I was called to Findlay by the Board of Health on account of a suspected case of smallpox at the County Infirmary. I found an aged negro suffering from a mild attack of smallpox. There had been considerable exposure. Vaccination of all the inmates was ordered, and arrangements made to remove the patient to an isolated building under the control of the township board of health. There was no spread of the disease.

February 26th, I went to Lorain at the request of the health officer. An outbreak of smallpox had been started there by an unreported case, a school child who introduced the disease into a school, from which it spread to a number of families. I visited a number of the families with the health officer, and in the evening met the board of health and discussed additional measures to prevent further spread of the disease.

April 10th, I was called to Springfield by the health officer to advise in reference to a case of smallpox, to which there had been a number of exposures, and measures to be taken. The patient claimed to have been exposed to what was called chickenpox at a boarding house in a suburb of Detroit, Michigan. I wrote to the health officer of Detroit for information, and he replied that he had referred my communication to the rural health authorities. They have failed to answer my letter.

March 28th the health officer of Wauseon called me there on account of suspected smallpox. I found a woman in the pustular stage of

smallpox. The woman was taken sick a day or two after arriving at Wauseon, having come from West Moreland, Kansas. She claimed that they were having a number of cases there of what the doctors were calling chickenpox. A letter to the Secretary of the Kansas State Board of Health met with a reply practically confirming this report. There had been a good many persons exposed at Wauseon, but these were found and vaccinated, and there was no further spread of the disease.

April 17th, at the request of the health officer, I visited Conneaut, a considerable outbreak of smallpox being reported there. On reaching Conneaut I was shown a number of the cases, there still being some doubt as to the diagnosis. While many of the cases were mild and some of them might, if seen alone, not have been recognized, there were on the other hand some marked cases of smallpox present and there could be no doubt as to the character of the outbreak.

I was unable, with the time at my disposal, to definitely trace the origin of the disease. I was able to find several families having had cases of what had been pronounced chickenpox, more than six weeks prior to my visit, and to trace other cases, which were undoubtedly smallpox, to these so-called chickenpox cases.

It was evident that the disease had been present in Conneaut for at least two months. I found in the private hospital that the physician to whom it belonged had undoubtedly gone through with a mild attack of smallpox, though he was inclined to doubt this. His two nurses, young ladies, were recovering from the disease, and by recovering I mean simply that the eruption was still present, though they had not been much sick; and a man in bed with a broken leg showed an eruption, though according to his story and that of the attending physician there had been little constitutional disturbance, the eruption being practically the only symptom of the disease.

I met with the Board of Health and the question of preventive measures was fully discussed. The board had already quarantined a number of houses and it was decided to enforce proper quarantine and disinfection in families where the disease had occurred but had also disappeared. There were twelve patients still having the disease when I was there. The entire number of cases that had occurred could not be learned at that time, but the health officer has since reported a total of thirty-eight cases.

April 27th the health officer of Conneaut telephoned me that Dr. Barkey, of Erie, Pa., had been brought to Conneaut and had pronounced the disease not smallpox. He also stated that they were having similar cases in Erie which were not quarantined or considered as smallpox. The Board of Health held a meeting and the health officer stated that it was proposed to dismiss quarantine except for those actually sick with the disease. I notified the health officer that unless the quarantine reg-

ulations of the State Board of Health were strictly enforced the Board would at once take charge, appoint the necessary health officers and guards, to be paid by the city, and that suit would be brought against the members of the Board of Health for failure to enforce the rules of the State Board of Health.

The following day I received a copy of the Conneaut paper, containing denials of their being smallpox in Conneaut, and also an article stating that the disease at Kingsville, a small village near Conneaut, which had been pronounced smallpox by the health officer of Conneaut, was nothing but chickenpox, and that the quarantine had been dismissed and schools would be reopened.

I thereupon explained the situation by telephone to Dr. Chapman, at Toledo, and requested him to go to Conneaut. Dr. Chapman will inform you of the result of his visit.

Dr. Chapman wrote me in reference to Dr. Barkey from Erie: "I have looked up the standing of Dr. Barkey and find by Polk's Directory that he is not a graduate of any school, but was given a license to practice medicine by the College of Physicians and Surgeons of Toronto, Canada, an institution that does not grant degrees and has no teaching faculty."

Dr. Lee, Secretary of State Board of Health of Pennsylvania, to whom I referred the statement of Dr. Barkey that "A similar disease was prevailing in Erie which was not quarantined" wrote me that he had inquired of the health officer of Erie about the matter and had learned that this statement was not true. The physician having charge of the cases at Kingsville denied the newspaper reports about cases there, and stated that they had been and would continue to be treated as smallpox.

A communication was received from the health officer of Canton stating that smallpox at that place and at Beach City had been introduced by persons who had contracted the disease at Cleveland. He stated that the Canton Board of Health was considering the question of quarantine against Cleveland, and expressed a lack of confidence in Cleveland's method of dealing with the disease.

The outbreak at Elyria, Lorain and in Henry county were suspected to be chargeable to Cleveland, though there was no good proof of this.

After consulting Dr. Miller about this matter I went to Cleveland, April 8th, and Dr. Miller and I called on the health officer the next morning. He stated that cases of smallpox, as soon as reported, were either removed to the hospital or quarantined where found. In the latter case guards were placed over the house, night and day, and in some instances both front and rear entrances were guarded. At the time of our visit he reported thirty-one houses in the city as under quarantine for smallpox. There was a smaller number of cases at the

smallpox hospital, and a few persons were being held at the Detention Hospital on account of having been exposed to smallpox. He stated that he had had at one time more than one hundred houses in the city quarantined on account of smallpox. His reason for not making greater use of the smallpox hospital was that its location, about seven miles from the public square, was such that in cold weather it was hazardous to take smallpox patients there. The school children, with few exceptions, had been vaccinated, and he had requested employers of large works to have their employees vaccinated.

We urged upon him a greater use of the smallpox hospital, and that a house to house inspection be made in the infected district, to look for hidden or unreported cases, and to vaccinate all the unprotected in this part of the city.

Cleveland has reported 380 cases and four deaths from smallpox since January 1st, 1900.

In addition to these visits of the Secretary on account of smallpox, Dr. Chapman went to Conneaut, mention of which was made, and to Holgate, Henry county, and several places in that neighborhood. A very considerable outbreak occurred here, difficult to control, which occasioned several visits by Dr. Chapman.

March 7th, Dr. Stanton was called to see a prisoner in the jail at Lebanon, suspected to have smallpox. The disease proved to be chickenpox.

Our medical inspectors have made the following visits. In all these cases the diagnosis of smallpox was in question or dispute:

Dr. Hoover, of Cleveland, was sent to Lodi, Medina county, February 12th. He found a well marked case of smallpox. He remarks, "How there could have been any doubt about the diagnosis seems strange." One other case was reported there.

February 6th, he visited Lorain and sustained the health officer in his diagnosis of smallpox.

March 9th he visited Elyria, and again on the 11th. Under date of March 14th he reported that the questionable cases there were smallpox. Smallpox had prevailed in Elyria for some time before Dr. Hoover's visit, according to the report of the health officer, but had been called chickenpox. There was difficulty in controlling the disease until the diagnosis was firmly established.

Dr. Laudick, of Lima, on March 19th, was sent to Cridersville and to Shawnee township, Allen county, where the diagnosis was in dispute. He found nine cases of smallpox in two families in the village, and seven cases in three different families in the township.

On March 22nd he went to McGuffey, Hardin county, where he found three cases of smallpox, one having passed through the disease and recovered under the diagnosis of chickenpox. It is supposed that

the disease was caused by a letter received from Plain City. Another case was found in a farm house nine miles north of McGuffey.

On February 17th, Dr. Collamore, of Toledo, went to Bellevue, where he found four cases of smallpox. They have since reported five additional cases.

March 8th, he went to New Bavaria, Henry county. This is the neighborhood that Dr. Chapman visited afterwards to enforce proper preventive measures. He found several cases of smallpox, the second crop of cases, as the disease had been going on for some time.

April 10th, he visited Continental, Putnam county, to see a suspected case, which proved to be smallpox. The patient was the station agent of the Clover Leaf Railway at that place.

Dr. Marchand, of Canton, went to Beach City, near Canton, at the request of the president, Mr. Hartzell, who had been asked to come there and advise the Board of Health as to precautions against smallpox. Dr. Marchand reported one case there, an infant, said to have contracted the disease in Cleveland.

April 25th, and again April 28th, he visited New Berlin, near Canton.

May 4th he was sent to Mineral Point, as a letter from a physician there, coupled with Dr. Marchand's statement, made me fearful that smallpox, unrecognized, had been prevailing there for some time. Under date of May 7th, he reported: "I just returned from Mineral Point, where I found a case of smallpox in the person of a married woman who has a history of typical smallpox. She was exposed to the Swanson family, of New Berlin. The attending physician announced it chickenpox and still remains so." He reports, however, that the board of health has accepted the diagnosis of smallpox, and that the proper quarantine measures are being taken.

Dr. Moninger, of Columbus, was sent to Newark February 3d on the request of the health officer to see a suspected case of smallpox. The disease proved to be smallpox.

On March 8th, he went to Bloom township, Fairfield county, to inspect some cases of eruptive disease, suspected to be smallpox. The disease proved to be chickenpox.

On April 27th, he was sent to Waverly, where he found an engineer on the Norfolk and Western Railroad with smallpox.

On May 2nd, he went to Dennison, and found there an engineer on the Pennsylvania Railway sick with smallpox.

On the same date the health officer of Fredericksburg, Wayne county, telephoned that an engineer on the C. A. C. Railway had developed smallpox and was quarantined at his home about five miles from Fredericksburg.

These three cases were traceable to a railroad boarding house in Columbus in which smallpox developed some weeks ago. As soon as I was informed of this outbreak I notified the authorities of the rail-

roads implicated and requested them to require all their employes to be vaccinated.

While the outbreaks of smallpox have been numerous, the disease has been easily controlled, except, possibly, in Cleveland.

April 4th, Dr. Stanton and the Secretary visited Dayton to investigate proposed changes in the public water supply. This matter has been reported upon.

April 25th, Dr. Gemmill and the Secretary visited Lima to investigate proposed additions to the sewerage system of that city. Plans for these additions were not available at that time, but it is expected that the engineer of Lima will present them in person at his meeting.

April 26th, I visited Xenia and looked over the plans, and the route and location of sewers and sewage disposal works proposed for that city. These plans will also be presented at this meeting by the Engineer.

The Engineer, Mr. Flynn, visited Canal Dover February 14th, in reference to a proposed sewer for that place; Gloucester, February 16th, to inspect the source of a proposed water supply for that village; Galion, on March 3d, to investigate suspected pollution of the public water supply; Plain City, March 22nd, in reference to a proposed sewer; Versailles, May 1st, to inspect proposed water supply for that village, and Bucyrus, May 3rd, for the same purpose. His reports, except for Versailles, Bucyrus and Galion, have already been transmitted to the Board. These latter reports are for consideration at this meeting.

At the request of the Dennison Water Supply Company, who paid the expenses of the visit, Mr. Horton and Mr. Flynn were sent to Denison to make a test of the efficiency of the water filters recently installed there. Their report will be presented later.

In addition to investigations already given the following ones should be made note of:

On January 29th, Mr. Flynn went to Zanesville, and with Dr. Crossland made an inspection of the several outlets proposed for the sewer in Slagoe run.

January 31st, Dr. Stanton, assisted by the Engineer, investigated an alleged nuisance arising from the improper disposal of the sewage of the Ohio Soldiers and Sailors Orphan's Home at Xenia. A copy of their report was sent to the Trustees of that institution.

On February 12th, Dr. Miller and the Secretary had a conference with the authorities of Lakewood in reference to sewerage for that hamlet.

On February 22nd, Dr. Stanton investigated the sanitary condition of the Court House at Xenia. A copy of his report was sent to the Commissioners of Green county. The Board's condemnation of this building was of assistance in securing the action which has been taken by the County Commissioners to build a new Court House.

On March 29th, Dr. Warner, assisted by the Engineer, investigated the sanitary condition of Sidney, with special reference to its needs for a system of sewerage. A copy of their report was furnished to the board of health of Sidney.

April 26th, Dr. Warner visited Circleville in reference to proposed changes in the sewerage arrangements of that city. Dr. Warner will report, I believe, that Circleville has abandoned, for the present, the intention of constructing a new outlet sewer. This serves to bring up a matter I wish to present.

The Board has approved the outlet of certain sewers with a provision that sewage purification works shall be constructed within certain named dates. The time for construction of such works has expired for the following places:

At Evanston, April 2nd, 1895, the Board voted to approve the outlet of a proposed sewerage system provided "that the corporation of Evanston will agree to purify its sewage in a manner satisfactory to the board and within three years from the completion of the proposed sewerage system, if deemed necessary by the Board."

At Salem, April, 1895, plans for improving the sewerage were approved provided "the properly constituted authorities of Salem will agree that within the space of two years all the constant or dry weather flow of sewage shall be delivered at a safe and proper outlet, and shall be purified in a manner satisfactory to the Ohio State Board of Health, that the sewerage plan which was submitted to the representatives of the Board on July 10th, be approved, otherwise disapproved." (No reply received to this.)

At Warren, October 31, 1895, the Board voted to approve the plans for proposed additional sewerage provided "sewage purification works, satisfactory to the Board, shall be built within two years from date of the first use of the new sewers, and provided further, that all sewage from Warren shall be by that time satisfactorily purified before discharging it into the Mahoning river."

At Chillicothe, May 11, 1897, the Board approved plans for sewerage and sewage disposal provided "the sewage disposal works shall be ready for operation, and the temporary outlet into the Scioto river shall be abandoned within a period of three years from date."

At Napoleon, October 13, 1898, plans for a system of sewerage were approved provided "that the sewage shall be purified in a manner satisfactory to this Board within three years from date."

I would recommend that an investigation be made of each of these cases to determine whether the conditions now existing are such as to warrant the Board in requiring sewage purification works to be built; and that in all cases where it is found that sewage purification is not yet

urgently demanded, action be taken by the Board to extend the time within which works must be built.

Since the last meeting of the Board mail votes have been taken upon the following propositions, which should be reaffirmed by a *viva voce* vote at this meeting:

Plans for a sewerage system for Lakewood with purification of dry weather flow only, were disapproved December 21, 1899.

Amended plans for Lakewood, providing for purification of all the sewage, but permitting the temporary use of a ditch to carry sewage to the lake were since approved by a mail vote.

Plans for a sanitary system of sewers for a part of the village of Canal Dover, with an outlet to the Tuscarawas river, were approved, with the provision that the sewage be purified whenever required by the State Board of Health.

The Board voted to approve plans to enlarge and extend the sewerage system of South Brooklyn, provided a map be furnished to the Board showing location of the sewer in the various streets, and its outlet. This map has not yet been received.

A new water supply for the Hospital for Epileptics at Gallipolis, to be obtained from deep wells, was approved.

Plans for changes and extension of the water supply for Dayton were approved.

The outlet of a sewer for Plain City, said outlet being Big Darby creek, was approved.

The examination of the two Miami rivers was begun in April. Stations have been established at the following places: On the Big Miami and its branches:

- Urbana, on Mad river, above and below.
- Springfield, on Mad river, above and below.
- Springfield, on Buck creek, above.
- Dayton, on Mad river, above.
- Dayton, on Stillwater creek, above.
- Dayton, on the Big Miami river, above and below.
- Sidney, on the Big Miami river, above and below.
- Troy, on the Big Miami river, above and below.
- Piqua, on the Big Miami river, above and below.
- Middletown, on the Big Miami river, above and below.
- Hamilton, on the Big Miami river, above and below.
- Cleves, on the Big Miami river, below.
- Greenville, on Greenville creek, above and below.
- On the Little Miami and its branches:
 - Xenia, on the Little Miami river, above and below.
 - Loveland, on the Little Miami river, above.

Linwood, on the Little Miami river, below.

Batavia, on East Fork of the Little Miami, above and below.

South Charleston, Little Miami, above.

A new assignment was made of the offices in the addition to the State House. The Board has been given a very large room on the southwest corner, which will be divided into three office rooms. Two additional rooms were given us for the engineer. These are on the top floor, next to the four rooms assigned for a laboratory.

Respectfully submitted,

C. O. PROBST, Secretary.

OCTOBER MEETING.

A regular meeting of the State Board of Health was held at the office of the secretary, in Columbus, October 17th and 18th, 1900.

There were present Dr. Gemmill, Dr. Miller, Dr. Warner, Dr. Chapman and Dr. Crossland. Dr. Stanton was detained at home on account of illness, and Mr. Hartzell was absent in Europe.

Dr. Gemmill presided.

On motion of Dr. Warner, it was voted to postpone the reading of the minutes of the secretary.

A delegation from the city of Springfield, composed of the trustees and superintendent of the water works, and the engineer, city solicitor and health officer, appeared before the Board in reference to securing the Board's approval for an additional water supply for that city. No plans having been prepared the matter was discussed without action.

A committee from Geneva, consisting of the mayor and members of council, appeared before the Board to urge the approval of plans for a public water supply which had already been submitted to the Board by mail. Arguments in favor and against the supply were heard and the matter was referred to executive session.

Mr. H. E. Riggs, the consulting engineer for the city of Bowling Green, and the city solicitor of that city, presented plans for a system of sewerage for Bowling Green, which they asked to have approved by the Board. The matter was referred to executive session.

The director of public improvements, the city engineer and the chairman of the Columbus Sewer Commission, appeared before the Board and discussed the question of plans for purifying the sewage of the city of Columbus. They were requested to formulate in writing the plan which they wished to have acted upon by the Board.

The city engineer and members of the Board of Water Works Trustees of the city of Zanesville presented plans, which they asked to have approved, for the installation of mechanical filters for the purification of the public water supply of Zanesville. The matter was referred to executive session.

Mr. L. C. Klipstine, of Versailles, addressed the Board in favor of a public water supply for said village, the matter having already been submitted to the Board by mail.

The Board then went into executive session.

On motion of Dr. Warner, it was voted to approve the proposed water supply for Versailles, to be obtained from driven wells located on Swamp creek in the northeastern part of the village.

On motion of Dr. Miller, it was voted to approve the proposed water supply for the village of Geneva, to be obtained from Grand river at or near a point due south of Geneva and near Rogers Corners, upon the condition that it be purified by filtration, or otherwise, in a manner satisfactory to the State Board of Health; and that the plans for purifying the proposed supply be approved by the Board.

On motion of Dr. Warner, it was voted to approve plans for a sewerage system for the city of Bowling Green subject to the following conditions:

1st. That the present sewers now in use be abandoned for carrying house drainage.

2d. That provision be made for purifying the sewage in a manner satisfactory to the State Board of Health within three years' time from the completion of the main outlet sewer.

Dr. Chapman presented a map showing the location of a proposed sewer for Sewer District No. 36, in the city of Toledo, and stated that the matter had been referred to him to present to the Board for its approval of the location of said sewer. He stated further that the matter had just been presented to him and he had not had time to fully investigate it.

On motion, of Dr. Warner, the matter was referred to Dr. Chapman as a committee of one for further investigation and report.

On motion of Dr. Chapman, it was voted to appoint a committee to investigate and report at the next meeting upon the proposed plans for purifying the water supply of Zanesville.

The director of public improvements of the city of Columbus invited the Board to make a tour of inspection along the Scioto river up to and above the place where it is proposed to locate a storage dam to furnish a public water supply for the city of Columbus.

On motion of Dr. Warner, the invitation was accepted by the Board with thanks.

Adjourned to 8:30 a. m. of the following day .

SECOND SESSION.

October 18th, 1900, 8:30 A. M.

The Board met pursuant to adjournment. Members present as before.

The secretary presented an abstract of his quarterly report.

On motion of Dr. Chapman, it was voted to approve the report and it was ordered printed in the Ohio Sanitary Bulletin.

On motion of Dr. Chapman, it was voted to approve an additional water supply for the village of Lynchburg, to be obtained from Sulphur spring, located about one and one-fourth miles northeast of the village, but with the provision that by ditching, or other necessary means, the spring be protected against surface pollution. The supply to be taken from Lynn spring was disapproved.

On motion of Dr. Warner, it was voted to approve a public water supply for the village of Waynesville, to be obtained from wells located just south of the village in low ground between the hills and the river. The proposal to establish an emergency suction line to the river was disapproved.

The secretary presented a report of the committee appointed to investigate charges that the city of Cambridge was violating the orders of the State Board of Health in making use of Wills creek as a part of their public water supply.

On motion of Dr. Chapman, the secretary was instructed to request the approval of the attorney-general of the employment of necessary legal council to enforce the orders of the Board in reference to Cambridge.

On motion of Dr. Warner, it was voted to hold a joint meeting of the State and local boards of health following the meeting of the State Board of Health in January, 1901.

The secretary was instructed to prepare a program.

On motion of Dr. Warner, the secretary was authorized to introduce a Citizens telephone at the office and at his residence.

On motion of Dr. Miller, it was voted to suspend the rules of the Board regulating the transportation of dead bodies and to grant the request of Surgeon General Wyman, of the Marine Hospital Service, to permit the remains of the late Dr. W. R. McAdam, assistant surgeon of the U. S. M. H. S., to be transported through the state of Ohio.

The secretary presented a communication from Mr. C. L. Penney, superintendent of the Lorain Water Works, requesting the State Board of Health to approve of the substitution of iron for alum as a coagulant in the filtration of the public water supply of Lorain.

On motion of Dr. Miller, it was voted to permit such experiments to be made as they deemed proper to determine the efficiency and desirability of iron as a coagulant.

The president appointed Dr. Warner and Dr. Chapman a committee to investigate and report upon plans proposed for improving the water supply for the city of Zanesville.

Dr. Warner reported that he had visited Plain City as a committee to inspect the outlet of a proposed sewer for that village. The matter

had been previously presented to the Board and the outlet of the sewer approved. His investigation, made at a time when the creek into which this sewer would discharge was practically dry, made it advisable, in his opinion, that the action of the Board in approving the outlet of this sewer be rescinded, and he moved that this be done. The motion was carried.

Dr. Warner stated that, in his opinion, an outlet for this sewer might be permitted further down the stream, the sewage to be purified when deemed necessary by the Board. The secretary was instructed to notify proper persons (the sewer being a private sewer) that the Board would consider amended plans at such time as they might present them.

Dr. Warner reported that, acting as a committee for the Board, he had visited Chillicothe to determine whether the sewage of that city was injuriously polluting the Scioto river. The river was not found to be injuriously polluted, and Dr. Warner moved that the order of Board, requiring Chillicothe to construct works for the purification of its sewage not later than three years from the date of approval of the plans for sewerage be rescinded and that the time for the construction of such purification works be extended two years from the present date. The motion was carried.

On motion of Dr. Miller, it was voted to approve plans for sewerage for the village of South Brooklyn, to-wit: a five foot storm water sewer in Pearl street, and a 22-inch sanitary sewer discharging into Big creek, in accordance with maps and plans submitted.

The Secretary presented the application of the City Sewer Commission of Xenia for approval of changes in plans for a sewage disposal plant for that city previously approved by the Board; such change being to locate the proposed filter beds opposite Station 86 + 32 and the name of Joseph Cromwell on Plate D, of the engineer's report as filed with the Board.

The report of the engineer of the State Board of Health and of the local engineer showing the location of the beds and the character of the soil to be suitable for the purpose desired, it was voted to approve of this change in plan.

The Secretary presented a report of an investigation of an outbreak of typhoid fever at Union Furnace, Hocking county.

The report was received.

On motion of Dr. Warner, it was voted to submit the question of approving plans for sewage disposal for the city of Columbus to a committee for investigation and report.

The president named as members of this committee Drs. Warner and Crossland and the Secretary.

The Secretary recommended that bills be prepared for submission to the next General Assembly extending the powers of the State Board of

Health with reference to the protection of public water supplies, and also making certain changes in laws relating to local health authorities.

On motion of Dr. Miller, Dr. Chapman and the Secretary were appointed a committee to prepare such measures, and they were authorized to employ legal assistance if they deemed it necessary.

The following resolution, offered by Dr. Chapman, was adopted:

Whereas the printing of the last Annual Report of the State Board of Health by the Westbote Company was of such inferior character, by reason of bad type, poor press work and bad selection of paper, as to render parts of it unreadable, and largely lessen its value, be it

Resolved, that the attention of the Supervisor of Public Printing be called to this matter and that he be urged and requested to use such measures to secure the proper printing of future reports of the Board as are within his power.

There being no further business, the Board adjourned.

QUARTERLY REPORT OF THE SECRETARY.

October Meeting, 1900.

Mr. President:—

I beg leave to submit the following quarterly report:

Since the last meeting of the Board investigations have been made at the following places in reference to water supplies or sewerage:

Bellevue, increase of water supply, investigation made by Dr. Chapman, on May 16th.

Springfield, increase of water supply, investigation made by Dr. Warner and the Engineer, June 14th.

Troy, proposed sewerage system, investigation made by Dr. Crossland with the Engineer, June 27th.

Leipsic, new water supply, investigation made by the engineer, June 10th.

Delaware, proposed sewerage system, investigation made by Dr. Warner with the Engineer, July 11th.

Fort Recovery, new water supply, investigation made by Dr. Warner with the Engineer, July 19th.

Painesville, proposed change and extension in water supply, investigation made by Dr. Miller with the Engineer, August 2nd.

Barberton (The Columbia Chemical Company), new sewerage system, investigation made by the Engineer, August 3rd.

Versailles, new water supply, investigation made by the Engineer, August 7th and 21st.

Evanston, extension of sewerage system, investigation made by Dr. Stanton, August 16th.

Geneva, new water supply, investigation made by Dr. Chapman with the Engineer, August 25th.

Cuyahoga Falls, new water supply, investigation made by Dr. Chapman with the Engineer, September 18th.

Cincinnati Branch Hospital, sewerage for an addition being built, investigation made by Drs. Stanton and Warner, September 21st.

Xenia, change in location of sewage disposal beds, investigation made by the Engineer, October 6th.

Lynchburg, change and extension in water supply, investigation made by the Engineer, October 9th.

Waynesville, new water supply, investigation made by the Engineer, October 12th.

These matters have all been fully presented to the Board, in special reports, except for Troy, Cincinnati Branch Hospital, Xenia, Lynchburg and Waynesville.

I understand that the committee found that no plans had been prepared at Troy.

The reports for Xenia, Lynchburg and Waynesville are to be presented at this meeting.

Following is a record of the votes of the Board taken by mail, upon the question of approving plans for water supplies or sewerage, on changes or extensions thereof. The Board at this meeting should ratify their action by a *viva voce* vote:

Bellevue, to increase the present storage capacity of water by the construction of an additional reservoir. Plans approved.

Kenton, works for sewage purification for the North Sewer District. Plans approved.

Delaware, new sewerage system with discharge of crude sewage into the Olentangy river. Plans disapproved.

Mingo Junction, investigation showed pollution of the public water supply, approved conditionally by the Board July 28th, 1898. It was voted to withdraw said approval.

Fort Recovery, new water supply. Voted to approve on the following conditions:

1. That the small run through the water works lot be carried through same in a water-tight sewer of such dimensions as will care for the storm flow of said run, and that lateral drains be run to this sewer from both sides of the lot so as to effectually drain same and carry off the objectional surface and subsurface drainage in the vicinity of the proposed water works.

2. That the plans for this work be submitted to the State Board of Health for approval, and

3. That the purity of the water be maintained to the satisfaction of the State Board of Health by proper protection of the well site, the removal of all sources of pollution, and by such other means as are necessary.

Barberton proposed sewerage. Plans approved on condition that if at any time the sewage from either source shall be the cause of a

nuisance, the company agrees to provide some other way of disposing of the sewage which will be satisfactory to the State Board of Health.

Painesville, proposed addition to water supply. Plans were disapproved.

Evanston, extension of sewerage system. Plans were approved on the condition that the village of Evanston agrees to purify its sewage in a manner satisfactory to the State Board of Health whenever deemed necessary by said board; or join with the city of Cincinnati and other corporations interested in plans to purify the sewage or divert it from Mill creek when authorized by legislative action.

Leipsic, water supply. Plans approved upon the condition that the present purity of the water be maintained.

Cuyahoga Falls, water supply. Plans approved upon the condition that the present purity be maintained by the prevention of local pollution, and by such other means as may be necessary.

Greenville, the question of rescinding the action taken at the January meeting, approving outlet of proposed sewerage system. It was voted not to rescind former action.

Versailles, new water supply. Plans were disapproved. As additional evidence of quality of the proposed supply has been obtained, the Board is requested to reopen the case at this meeting.

In addition to the investigations before mentioned the following should be noted:

May 21st the sewers of Ashville were inspected by the Engineer, to determine the cause of a nuisance arising therefrom.

June 25th, Dr. Warner inspected the river at Chillicothe to determine whether the sewage of the city was the cause of the objectionable pollution of the river.

July 28th, Dr. Chapman visited Wapakoneta in reference to an alleged nuisance arising from insufficient sewerage.

August 3d, Dr. Chapman investigated a stream nuisance alleged to be caused by the sewage of Fostoria.

August 18th, Dr. Stanton inspected the sanitary condition of Blanchester.

October 8th, the Secretary, with the Bacteriologist, investigated an outbreak of typhoid fever at Union Furnace.

Smallpox has been reported in 71 places since the last meeting of the Board. The total number of cases reported from May 8th to October 15th, was 1008, and seven deaths. The total number of cases from January 1st to October 15th, 1900, was 2,064, and 21 deaths.

Investigations of smallpox were made by a member of the Board or by a Medical Inspector at the following places: New Vienna, Glendale, Frederickstown, Cincinnati, Murray City, Belleville, Utica, Chesterville, Bucyrus, California, Peebles, West Union, Loveland, Cleves, McGuffey.

Portsmouth, Brunswick, Rarden, Wellston, Coalton, Zaleski, Kent and Kenton.

The disease continues to be mild, causing but few deaths, (58 in 4,489 cases since the first outbreak, or 1.29 per cent.), and exciting but little public alarm.

I would recommend that arrangements be made for the annual meeting of State and local boards of health in January.

Respectfully submitted.

C. O. PROBST,
Secretary.

CONTAGIOUS DISEASES.

REPORT OF AN INVESTIGATION OF TYPHOID FEVER AT MINGO JUNCTION.

In July, 1898, the Board voted to approve a public water supply for the village of Mingo Junction, which was to be taken from a crib placed in the bed of the Ohio river. (See Annual Report of Ohio State Board of Health for 1898, page 119.)

The Board, in its approval, reserved the right to condemn this supply if, after its construction, it should be shown that the filtration was imperfect and the water not of good quality.

Reports having been received from the local board of health that there was an unusual prevalence of typhoid fever in the village, and upon the request of such board, a committee of the State Board, Dr. J. C. Crossland was appointed to investigate, and reported as follows:

Having been appointed by the Board to visit Mingo Junction and investigate and locate the cause of the unusual amount of typhoid fever prevailing there, I accordingly visited said place on May 16th, and in company with Dr. W. W. Morgan, health officer, and members of local board of health, went over the town and collected seven samples of water, from different sources, all of which are pretty extensively used.

The chief supply is furnished by a private company from a so-called filter or crib in the channel of the Ohio river, about seventy-five or one hundred feet from the shore, and approved by the Board some three or four years ago.

I learned from the water company that they had been pumping through an auxiliary pipe directly from the river for about eight weeks. This, they claimed, had been necessitated by work which had been in progress on their pipe lines. This would not, however, explain the typhoid. Pumping from the crib had been resumed at 10:00 o'clock of the day of my visit, so that the only supply from the filter obtainable was from the power station hydrant. Therefore, a collection was taken, also from the river near the crib for comparison. As expected, the comparison showed the water near the crib to be very slightly modified by the so-called filter.

There is a spring in the south part of town on the main thoroughfare, owned by a church, and whose deed provides that the public shall never be denied the benefits and comforts of this natural and wholesome supply of water. Here the would-be benefactor and sanitarian conflict. A large sign over the spring reads:

"This spring is Condemned by the State Board of Health.

"C. O. PROBST, M. D."

This sign seems to inspire no fear in the hundreds who come to drink and carry home this water. This spring has no protection against

surface drainage. I was told council would probably improve and protect the spring from surface drainage, if recommended by the board of health.

Two large iron mills and three or four furnaces on the river bank just above the crib have their own water supply and turn the sewage into the river. (It should be remembered also that Steubenville is but three miles above.)

Most of the population use water from two or more of these sources. From an examination of the situation, as well as the analyses, I believe the chief danger to be in the river supply. This is very dangerous. In fact, it is about as dangerous a condition as could be conceived.

I recommend that the local board of health be advised to secure the Patten spring from direct surface pollution by proper bowl and wall.

I recommend also that the supply furnished from the river by a private company be condemned, and that they be required to purify the water furnished the city in a manner satisfactory to this Board.

Other samples were collected for examination and reported upon by the chemist as follows:

RESULTS OF CHEMICAL AND BACTERIOLOGICAL EXAMINATION OF WATER FROM
MINGO JUNCTION.

PARTS PER MILLION.

	Ohio river near intake.	Hydrant at power house.
Number of sample.....	1097	1098
Color .....	.13	.20
Turbidity	Less than .06	Less than .06
Sediment	slight	slight
Odor	slight	slight
	putrefactive	putrefactive
Oxygen required	2.80	3.08
Nitrogen as free ammonia.....	.034	.028
Nitrogen as albuminoid ammonia.....	.130	.137
Nitrogen as nitrates	trace	trace
Nitrogen as nitrites.....	.004	.010
Chlorine	28.6	28.2
Alkalinity	21.2	39.8
Incrusting constituents	53.8	73.8
Total solids	171.	189.
Volatile and combustible.....	73.	82.

No. 1099, Ohio river near intake. 6,000 bacteria per cc. Colon bacilli present.

No. 1100, Paul's drille 1 well. 24 bacteria per cc. Colon bacilli not present.

No. 1101, City pump at Brittel's. 550 bacteria per cc. Colon bacilli not present.

No. 1102, Patten's spring. 350 bacteria per cc. Colon bacilli present.

No. 1103, Hydrant at Dr. Morgan's. 5,400 bacteria per cc. Colon bacilli present.

"The chemical findings in samples 1,097 and 1,098 are quite similar in the two analyses, showing the waters are from the same source and

not modified to any extent. The results are fairly good for the Ohio river, but it is a polluted water in each case. That the water of the Ohio river at this point is a polluted one, is very satisfactorily shown by the bacteriological findings in samples 1,099 and 1,103, for in both of these samples typical colon bacilli were present, showing there had been intestinal discharges introduced into the river.

Of the three samples taken from the river, one (1,102, Patten's spring) was found to contain intestinal bacteria, and hence must be considered a polluted water.

The two well waters, 1,100 and 1,101, did not show the presence of any intestinal organisms, and therefore the results would indicate that these waters were not, at the time of sampling, receiving any direct pollution from sewage sources, and judged solely by the analytical findings, the well water would be called usable. It should be noted, however, that the surroundings of these wells, as given in blanks accompanying samples, are very undesirable, and chemical analyses of their waters would probably show their nearness to pollutions, which are not reaching the wells by direct channels."

The Board voted to approve the report and its recommendations, and also to rescind its action of July 28th, 1898, approving the public water supply for Mingo Junction. Notice of this action of the Board was sent to the health authorities of Mingo Junction July 30th, 1900. The Mingo Junction Water Company, through its Secretary, at Pittsburg, Mr. Benjamin L. Hirschfield, was notified that the Board had rescinded its former approval of the water supply for Mingo Junction, and that the company would be required to purify the water in a manner satisfactory to the State Board of Health within a reasonable time.

REPORT OF AN OUTBREAK OF FEVER AT LAKE ERIE COLLEGE, PAINESVILLE.

At the request of the president of Lake Erie College, the secretary went to Painesville on November 21, 1899, to make an investigation of an outbreak of fever among students of the college, to determine, if possible, the cause thereof, and reported as follows:

This college, for girls, is very pleasantly located in the outskirts of the village of Painesville. The usual attendance is in the neighborhood of one hundred. An outbreak of fever began there on October 12, 1899, the exact nature of which is still in dispute. In all there were 31 well defined cases, and besides eight or ten cases of short duration, with some of the symptoms of the disease, but little or no fever. The cases developed between October 12th and November 8th. Nineteen, more than one-half of the cases, developed during the week ending October 28th.

Following is a general description of the disease as furnished by the college authorities: Headache, fever, high in the beginning, 102,

103, declining gradually; never returning to first height except in one case, with relapses more or less severe. Tongue white, slimy, mucuous, in one case brown. Marked billiousness. Bowels constipated. Diarrhoea in but one case, and only for forty-eight hours. Sweating in a few cases. In one or two cases there was delirium. The duration of the disease varied from two to six weks. The physician to the college pronounced the disease typho-malarial fever. Dr. Hoover, of Cleveland, who was called to see some of the cases at the college, reported the disease to be typhoid fever. Many of the patients went to their homes just before or at the beginning of their illness. In eleven such cases the physician at home diagnosed the disease as typhoid fever. Among the patients was the daughter of Dr. B., of the Ohio State University. He reported finding the malarial organism in blood taken from this case. Except for this (Dr. B. being a competent observer), I should be inclined to consider the fever as typhoid. I should have stated that at least two other competent microscopists examined the slide prepared by Dr. Bleile, and confirmed the diagnosis of malaria.

I made a complete examination of the college and grounds, assisted by the attending physician, Dr. C. F. House, and the health officer of Painesville, Dr. E. D. Whitney, on November 21st. The drinking water, at the beginning of the outbreak, was obtained from a well located on the college grounds. No sources of pollution within a distance liable to contaminate the well, could be found. The water is pumped to a tank in the attic, and thence piped over the building. The tank is open, but there is no way apparent by which water in the tank could be accidentally polluted.

Soon after the outbreak, fearing the well might be the cause of the trouble, it was temporarily abandoned, and the city water, which is from the lake, crudely filtered, was turned into the pipes. Samples of the well and city water were collected on November 9th and were examined by our chemist, Mr. Horton, who reported as follows:—

RESULTS OF CHEMICAL EXAMINATION OF WATER FROM PAINESVILLE.

PARTS PER MILLION.

*Number of sample.....	822
Color.....	trace
Turbidity.....	none
Sediment.....	none
Odor.....	none
Oxygen required.....	.82
N. as ammonia free.....	.003
N. as ammonia albuminoid.....	.028
Nitrogen as nitrates.....	trace
Nitrogen as nitrites.....	none
Chlorine.....	4.8
Alkalinity.....	96.2
Incrusting constituents.....	31.8
Total solids.....	166.
Volatile and combustible.....	36.

*Sample taken from well at Lake Erie College.

"The results of the analysis show this to be an unusually good water. It is a soft water and contains very small quantities of organic matter as shown by the several findings. The chlorine is the highest factor and that comes within permissible limits."

Mr. Horton also reported upon two samples examined bacteriologically as follows:—

No. 815 Lake Erie College well, collected November 6, 1899.

No. 816 City water at college, collected November 6, 1899.

No. 815 contained 39 bacteria per c. c.

No. 816 contained 14 bacteria per c. c.

"No intestinal bacteria were found in either sample. The results indicate that both were very good waters. The foregoing chemical analysis bears out the bacterial findings for sample 815. The city water sample contained an extremely low number for a city water. It would be interesting to make a second quantitative examination of the city water to see if it again contains so few organisms or whether the present sample chanced to be an exceptionally low one bacterially."

Milk was obtained from a dairyman who keeps his cows near the college. He had a hog-pen near his cow barn, but as the odors from this were complained of by the college, this had recently been removed. There had been no sickness in the dairyman's family nor among his other customers. Apparently proper care was used in handling the milk and milk utensils.

The college building was in good condition. Some changes in plumbing were made just before school opened in September but no evidence could be found that the plumbing had any thing to do with the outbreak. The examination, as regards the discovery of conditions that could have produced an outbreak of typhoid fever, was wholly negative.

If we consider the disease to have been malarial fever, and if we accept the theory of the disease being carried by mosquitos, the evidence of an abandoned skating pond near the college may have some significance. The pond is located back of the main building, in which are the dormitories, and between the building and the cow stable and hog-pen spoken of above.

The pond was opened up in the winter of 1898-9, and was filled with overflow water from the elevator. The water was allowed to evaporate during the summer, and the pond became a prolific breeding ground for mosquitos. The winds which brought to the college the odors from the hog-pens, of which complaint was made, would also carry mosquitos to the building. As a matter of fact there was complaint of mosquitos, and some live specimens were found in the building as late as the time of my visit.

I am, of course, quite unable to state that this skating pond had any causal relation with the outbreak of fever, even counting it as of malarial origin, but I advised that it be abandoned and filled with earth.

Leaving the pond out of consideration, it can only be stated that the investigation failed to discover anything connected with the water or food supply, or with the sanitary condition of the college buildings, which was most excellent, which could account for this somewhat phenomenal outbreak of disease. The college authorities were much concerned about its occurrence, and they are most willing to make any changes which would improve the sanitary condition of the institution.

The college reopened January 4th, and the enrollment of students on January 19th, was eighty-six. No sickness of a typhoid or malarial character has developed since reopening.

Following is a report made by Dr. Perry L. Hobbs, analytical and consulting chemist, Western Reserve Medical College, who visited the college October 28th, and took samples of water for examination:

"1. I found the college proper and also the college grounds in as fine a sanitary condition as is possible to be maintained with your equipment. Your sanitary system is good and well maintained and in the whole of your plant, I could only criticize the water closet on the lower floor of your laundry. (This has been changed to a closet of the best and latest kind suitable for the place.)

2. In regard to your trouble arising from the well, it is simply out of the question as the chemical analysis shows, and an examination of the bed of the skating pond showed that it could not have come from there. A chemical examination and also bacteriological examinations of the well water, lake water and water from the pump on the farm where you draw your milk supply, showed them all to be free from contamination.

3. I found the surroundings of the barn where the cows were milked and housed, to be in an extremely bad condition and subject to the severest criticisms and am of the opinion that it is the one probable source of all your trouble and the one which should be remedied without question

4. All the details of the sanitary affairs of the institution were being carried out with the most careful attention and all supervision of the sick was most commendatory.

In conclusion, I would like to state that I am convinced without any doubt that the trouble did not emanate from the college buildings but was introduced, and in the manner above recited."

REPORT OF AN OUTBREAK OF TYPHOID FEVER AT UNION FURNACE.

Mr. L. G. Kilbourne, President of the Columbus Brick and Terra Cotta Company, at Union Furnace, called at the office of the Board and reported that a considerable number of cases of typhoid fever had developed among his workmen, and that three of his children, who had been

temporarily living in the village, had also contracted the disease. He requested that an examination be made. Accordingly, a few days later, to-wit, October 8th, the Secretary and Chemist went to Union Furnace to make an investigation. They reported as follows:

This is a small village of a few hundred souls, on the Hocking Valley railway, in Logan county. We called upon Drs. Beery and Switzer, the only physicians in the place, who had attended all but one of the cases. Dr. Beery has been practicing there twelve years. He stated that the village, and country immediately around it, had been entirely free from typhoid fever until about four years ago, when a young man who had been away from home returned and was taken ill with what was supposed to be malarial fever. He lived on a farm about one-half mile from the village. A little later his father contracted the disease. During his illness he was visited by a number of his friends and relatives, and some of them afterwards sickened with the same disease, several of these cases occurring in the village. Dr. Beery stated that since that time he and his partner, Dr. Switzer, had treated from twelve to fifteen cases each fall in Union Furnace and vicinity.

We afterwards learned, however, that a year or more prior to this time a Mr. Fisher, an employe of the company, was taken sick with typhoid fever while living in what is known as the Brown house. He was brought to Columbus, where he died.

The first case of the present outbreak was the daughter of Mr. Kilbourne. She was first seen by a physician August 3rd. She went to Union Furnace on July 11th, so must have contracted the disease there. The family was living in the Brown house. It was at first supposed that the patient had malarial fever, so no precautions were taken to disinfect stools, etc.

The second case had no known connection with this first case, being a man who lived just beyond the village. From the best information obtainable, he did not drink water from the well at the Brown house, though he did drink from the Vickers well, which is under suspicion. He was taken ill (i. e., was first seen by a physician), August 19th. The third case developed August 25th, a woman living in the village proper (the tile works are not quite in the village). No connection could be made out between this case and the other two.

September 11th the first of the workmen at the tile works to be affected was taken ill. Then there was one case on Sept. 17th, three cases on the 20th, one on the 21st, three on the 23d, five on the 24th, three on the 25th, one on the 26th, two on the 27th, one on the 29th, and four on October 1st. This makes 29 cases. Three of the patients died. It will be noted that 22 of the cases, or about three-fourths of the entire number of cases, occurred during eleven days, counting from September 20th to October 1st, inclusive. In addition to the 29 cases, both physicians and several other persons were ill for one or two weeks with ill-defined symptoms, which may have been due to typhoid infection.

The village suffered from a drought during the summer and many of the wells were dry. The drinking water for the men at the works was nearly all carried from the Brown well, at the house where the first case occurred. Twenty of the cases were among the employes of the tile works, and all but three of the 29 patients used water from the Brown well.

In connection with the tile works is a mine from which clay is taken. The men who worked in the mine did not drink water from the Brown well, using instead water found in the mine. None of them had the disease. The wives and children of the workmen who had typhoid fever did not use water from the Brown well, and they also escaped the disease. The circumstantial evidence strongly incriminates the Brown well.

Most of the wells are badly located as regards possibility of contamination. The village is located along a narrow valley, and, as usual, the privies are nearly all on higher ground than the wells. Many of the wells are in rock, and the earth cover to this rock is made ground, and in several places rather thin. In my judgment most of these wells are quite liable to pollution.

Samples of the water for chemical and bacteriological examination were collected from wells and springs; one of the latter being the supply used by the clay miners, and which is under consideration as the source of a general supply should the wells have to be abandoned. The results of the chemical and bacteriological examinations are appended hereto:

RESULTS OF CHEMICAL AND BACTERIOLOGICAL EXAMINATION OF WATER
FROM UNION FURNACE.

PARTS PER MILLION.

Wells.	McClan- nahan.	Peebles.	Vickers.	Brown House.
Number of sample	1413	1414	1415	1416
Color .....	.15	.12	.05	.10
Turbidity	trace	trace	none	trace
Sediment	slight	slight	trace	slight
Odor	faint	none	strong	none
	woody		putref.	
Oxygen required	2.93	1.58	1.95	2.18
N. as free ammonia .....	.079	.023	.032	.024
N. as albuminoid ammonia .....	.194	.090	.076	.080
N. as nitrates	24.08	none	trace	2.51
N. as nitrites .....	.010	.002	.090	.002
Chlorine	69.7	16.9	2.5	5.4
Total solids	809.	193.	632.	319.
Bacteria per c. c.	37,000	7,400	8,500	22,000
Colon present	no	no	suspi- cious	yes

These samples were collected October 8th, and five other samples were taken in small bottles, and their examination yielded the following findings:

Laboratory number.	Source.	N. as nitrites.	N. as nitrates.	Chlorine.	Bacteria per c. c.	Colon present.
1417.....	Kelly well .....	.007	.16	2.6	600	no
1418.....	F. J. Clark well	none	6.42	5.8	2,300	no
1419.....	Old Moore well	trace	6.75	14.2	95	no
1420.....	Dutrow well .....	.011	1.46	11.2	3,300	suspicious
1421.....	Drip in mine	none	trace	trace	7	no

No. 1,413, H. F. McClannahan well. All the findings in this sample, except the physical properties and the character of the bacteria are objectionable. The nitrates and chlorine indicate a large amount of pollution nearby, while the other results show the purification is but partial. The findings show too much pollution for safety.

No. 1,414. Peebles well. The objectionable findings here are the chlorine and the number of bacteria. The latter may be due to the fact that the well was not in use. The chlorine may be mineral in origin, as no evidence of past pollution appears in the nitrogen determinations. While the number of the bacteria is too high for a good water, yet they would probably be less numerous if the well were in use, and the other findings indicate a usable water.

No. 1,415, Simon Vickers' well. The objectionable findings are high nitrites, many bacteria, with some of a suspicious nature, a very bad odor, and some organic matter. The results are such as to class this water as not potable, if not unsafe.

No. 1,416, Brown house well. The presence of typical colon bacilli, such as were found, together with the recent evidence of pollution, as shown by the history of the epidemic of typhoid fever at this place, would condemn the use of this water. The remaining findings of the analysis are not favorable ones.

No. 1,417, Kelly well. The results indicate a usable water, although I should prefer better surroundings and less nitrogen as nitrites.

No. 1,418, F. J. Clark well. The results would indicate considerable purification, and they would also indicate there was considerable need for purification, as the water has seen pollution. The nitrates, chlorine, and number of bacteria are in accord with the surroundings of the well, and would class the water as undesirable, if not really unsafe.

No. 1,419, Old Moore well. The bacteria findings are quite satisfactory, but the nitrates and chlorine show the influence of the several privies above and around the well. It is an undesirable water.

No. 1,420, Dutrow well. All the findings are either suspicious or objectionable, and class the water as not potable.

No. 1,421, Drip in mine. Every determination is excellent, and the water is a desirable one aside from any slight mineral taste.

Mr. Kilbourne was notified of the results of the investigation. The Brown well was condemned as polluted and as the probable cause of the outbreak of typhoid fever. It was suggested that steps should be taken looking to the introduction of a better water supply for the village.

PUBLIC WATER SUPPLIES.

REPORT ON NEW WATER SUPPLY FOR BATAVIA.

The Board having been requested to approve plans for a new water supply for the village of Batavia, Dr. Byron Stanton was appointed a committee to visit Batavia and make the necessary investigation. Dr. Stanton visited that village on December 16, 1899, and submitted the following report:

The council of Batavia some months ago appointed a board of water works trustees to construct water works. The board proceeded to have wells drilled in different places at distances of from 100 to 200 feet from the east branch of the Little Miami river. Although the wells were sunk to the depth of from 50 to 80 feet, in but one was any water found, and in that the quantity was so small that pumping with a steam pump soon exhausted the supply and the idea of getting water from that source was abandoned. It is now proposed to take water from the east branch of the Little Miami river and purify it by filtration.

East branch is a tributary of the Little Miami, the confluence being near Milford. The stream and its branches run through Clermont, Highland and Clinton counties, and its course is mainly through a rough, hilly country, used mainly for tillage. But little grazing is done along the stream or its tributaries, and no town discharges sewage into the stream above Batavia. For at least ten months of the year the stream is clear. After a rain it is muddy for only a short time, owing to the topography of the country. My visit to Batavia was made soon after a rainfall of two or three days, in which about two inches of rain fell, and when the sample of water was taken for analysis the stream was about midway between the highest and the lowest points and the water was quite muddy, so that the analysis will not furnish an accurate criterion for most of the year. Just above the town there is a pool about 30 or 40 feet wide, nearly half a mile long, and varying in depth from four to ten feet. From this pool it is proposed to take the water. Near the upper end of the pool there are several houses, but these have no vaults that could contaminate the water. On account of its freedom from dangerous sources of contamination I believe that with proper filtration the water can be made fit for domestic uses.

H. C. Babbitt, engineer, of Tippecanoe City, has been employed as consulting engineer, but has not yet submitted to the trustees any definite plans for filtration, preferring to wait until he knows whether the State Board of Health will approve the proposition to take water from the proposed source.

Batavia is a town of about 1,000 inhabitants, but it is an old town, and the use of wells as a source of water for domestic use is giving way to cisterns, which are uncertain and unsatisfactory, and a larger and better supply is needed.

I would recommend that our Board request the engineer to submit plans for filtration, storage, etc., with the assurance that if these are satisfactory the source of supply will be approved.

The council of Batavia was notified that it would be necessary to furnish the Board with complete plans showing filtering apparatus and manner of operation, rate of filtration and amount of storage to be provided for.

At a meeting of the Board held May 9th, 1900, Mr. N. O. Goldsmith, vice president of the Wefugo Company, of Cincinnati, Ohio, presented the following plans for a water purifying plant for Batavia, which he requested, on the part of the council of Batavia, be approved by the Board:

The apparatus will consist of two treating tanks, each 20 feet in diameter, by 13 feet 4 inches deep. The raw water will be pumped into these treating tanks alternately. Attached to the side of the pump filling the treating tanks will be an auxiliary chemical pump operated by a steam cylinder of the pump. The coagulant used for the purification of water is sulphate of aluminum. A solution of this reagent will be made in two chemical tanks. These chemical tanks will be furnished with stirring devices continuously operated from a small engine. The solution of sulphate of aluminum will be taken from the chemical tanks by the auxiliary pump and discharged into the pipe supplying the treating tanks, the strokes of the auxiliary pump being same as those of the supply pump. We have in this way an accurate and uniform amount of chemical solution mixing with the raw water and flowing to the treating tanks.

In each treating tank will be an aerating device consisting of a pan fastened at the top of the vertical inlet pipe. The water will overflow from this pan into the treating tanks. In this way the water will be aerated.

As soon as one treating tank is filled, by means of an automatic controlling device, the supply of water is shut off from this tank and automatically turned into the second tank. This change, however, can only be made after the second treating tank is empty. The water will stand in each treating tank about six hours. This gives time for thorough precipitation and coagulation.

The outlet from each treating tank consists of a float pipe so arranged that the outlet is always near the top of the water. In this way the clear water is carried to the filter.

The filter will consist of a round cypress tank eight feet in diameter by about eight feet deep. This tank will have a double bottom. In the upper bottom will be placed the strainers which are made of brass, provided with phosphor bronze screens. These bronze screens have a

number of slits about one-hundredth of an inch wide and three-fourths inch long. In the bottom of the strainer is placed a brass ball so arranged that the downward flow of water is throttled by the ball while the upward flow of wash water is free.

The compartment between the two bottoms is for the clear water and to this the outlet pipe from the filter is connected. The filtering medium is crushed quartz of uniform size; the bed about three feet deep.

The inlet valve to the filter is controlled by means of a float so that the uniform level of water is kept upon the filter bed. The filter is provided with a mechanical stirring device consisting of a vertical shaft operated by reduction gears driven by a belt pulley.

Fastened to the vertical shaft is a cross arm upon which is fastened the heavy chains, during the washing process, which is accomplished by an upward flow of water, the stirring device is revolved, and the heavy chains are carried along with the cross arm and break up the sand bed bringing it into a uniform granular condition. The water is carried off through an annular wash trough fastened inside of the filter tank.

The outlet from the filter is controlled by means of a regulator so that the rate of filtration is kept at a uniform amount irrespective of the condition of the filter bed.

The water flows by gravity from the treating tanks on to the filter bed and from the filter bed into clear water well, which is 42 feet in diameter and 16 feet deep. The rate of filtration through the bed is one hundred million gallons per twenty-four hours per acre.

The Board voted to approve the plans subject to the following conditions, to-wit: That an agreement be entered into between the village of Batavia and the Wefugo Company as to the bacterial efficiency of the proposed filters, and that said company shall guarantee a bacterial reduction averaging ninety-seven per cent. when the number of bacteria in the raw or unfiltered water is in excess of seven thousand per cubic centimetre, and that the number of bacteria in the filtered water shall not average more than two hundred per cubic centimetre when the number of bacteria in the raw or unfiltered water is less than seven thousand per cubic centimetre.

A certified copy of the agreement mentioned in the above condition having been received from the Secretary of the Board of Water Works Trustees of Batavia, a notice was sent to the council of Batavia that the proposed water supply for that village had been approved by the State Board of Health.

REPORT UPON PROPOSED CHANGES IN THE WATER SUPPLY OF BELLEVILLE.

At a meeting of the Board held in Columbus May 9th, 1900, the Secretary reported that the Water Works Trustees of Bellevue were preparing to make changes in the public water supply and that a petition had

been received, asking that the matter be investigated. Dr. W. C. Chapman was appointed a committee to make the investigation and reported as follows:

Having been appointed to investigate and report upon the proposed additional reservoir for the storage of water for the use of the village of Bellevue, I visited that place May 16th, and inspected the present supply and the proposed location for the new reservoir.

In 1873 the first reservoir was constructed with a capacity of 31,000,000 gallons of water, with an area of eight acres. In 1882 a larger reservoir was placed contiguous to the old with a capacity of 34,000,000 gallons of water with an area of eleven acres, the two being used as one, allowed of the storage of 65,000,000 gallons. As the consumption is 500,000 gallons daily, the supply is not sufficient to allow of sedimentation, there being considerable mineral matter suspended in the water when let into the reservoirs in the winter and spring. It is proposed to construct a new reservoir this year covering an area of 18 acres with a capacity of 80,000,000 gallons adjoining those now in use—making the whole practically one, with a total capacity of 145,000,000 gallons—sufficient for all present purposes and it is believed for many years to come. The quality of the water is good, being furnished by a stream which passes through a farming country not thickly settled and having no drainage from large cities or towns. The water is now clear and according to reports made by C. A. Brown, good, potable water. So large a body can never, in my opinion, become stagnant and therefore a nuisance.

I recommend that the State Board of Health approve of the measures taken by Bellevue to increase her storage capacity of water by the construction of the additional reservoir.

The Board voted to approve the report and the Water Works Trustees of Bellevue were notified that their plans to increase the present storage capacity of water by the construction of an additional reservoir had been approved by the State Board of Health.

REPORT ON A CHANGE IN THE WATER SUPPLY FOR BUCYRUS.

An application was made by the Sandusky River Pipe Line Company to approve plans for a change in the water supply for the city of Bucyrus. The city for years has been supplied with water from the Sandusky river, which it was attempted to purify by passing through a Hyatt filter. The supply was not satisfactory, and was but little, if at all, used for domestic purposes.

The engineer of the Board, Mr. Benjamin H. Flynn, was sent to Bucyrus to investigate and he submitted the following report:

Bucyrus was visited on May 3rd, 1900, and the source of the new supply investigated in company with Mr. F. P. Kahler, superintendent

of the Bucyrus Water Company, and Mr. Smith and Mr. G. L. Wells, who are in charge of the new supply which is being put in by the Sandusky River Pipe Line Company.

The plans for the new supply are briefly as follows: The water from a small tributary of the Sandusky river is to be impounded and carried by gravity through a 14 inch main to the present pumping station and be distributed as before only without any attempt at filtration.

The area of the watershed of the creek is estimated at 2,495 acres; no accurate surveys to determine this figure have been made and the above number is approximate. The annual rainfall on this watershed was estimated at 35 inches of which it was estimated that 50 per cent would run off. These figures will give 3,643 acre feet of water per year or an average of nearly 10 per day which equals 435,600 cubic feet or 3,265,000 gallons.

This runoff is to be impounded by a reservoir formed by building an earthen dam, with masonry waste weir, across the lower end of the small stream. It will flood between 55 and 60 acres of land and will have a capacity of approximately 150,000,000 gallons.

From this it is seen that the reservoir will hold about one-eighth of the runoff of the watershed and enough to supply Bucyrus with water for about six months without refilling.

The watershed consists of good farming land, most of which is under cultivation, and the remainder in timber and pasture. At the upper end of the watershed there is quite an extensive tract of timber, small portions of which are swampy. In fact, several quite extensive areas of this watershed were formerly swampy but they have been tilled and now are well drained. The soil varies from clay to a rather stiff loam, none of it seems to be very light.

A house to house canvass gave the following for the number of people and the amount of stock: Population, 133; horses, 91; cows, 145; hogs, 470; sheep, 406. These figures are only approximate, however, as without a survey it was impossible to accurately determine the limits of the watershed. The average population per square mile of the watershed is 34, which is four below the average of the Sandusky watershed.

The privies are of the usual type found in the country, some having vaults and some no excavation at all. None, however, are directly over the ditches leading to the reservoir, or even near them. The barn-yards are full of manure, much of which is now being hauled to the fields for fertilizer.

The watershed is traversed by six public roads, the drainage from all but a small portion of which will enter the reservoir.

As will be shown upon the maps to be presented, it is intended to divert to the river the runoff of about 80 acres near the reservoir. This will include the drainage from a school and a couple of farm houses

together with that from a section of the public roads which cross just west of the reservoir.

The engineer in charge of the works was not able to furnish complete plans at this time but stated that such plans would be forwarded before May 8th, from which the details of construction of the reservoir and pipe line may be obtained.

As supplementary to this report is given the following communication received from Mr. George L. Wells, engineer for the Sandusky River Pipe Line Company:

We send you herewith one preliminary map of reservoir, and one map showing watershed, reservoir and pipe line for proposed water supply for the Bucyrus Water Comany. The preliminary map shows very close approximations of the depth of water that will be obtained when the reservoir is completed. The watershed map shows the lands lying on the slope which drains into the two creeks which carry water to the reservoir.

The area of the watershed is 2,495 acres as computed from the map. The actual population in March 1900 was 264 persons.

Our computations for rainfall in this vicinity have been taken at 35 inches per year. This in round numbers gives a total annual rainfall for this watershed of 2,360,000,000 gallons.

The watershed is very flat so that the ground takes up a large part of the water. We have noticed that after a heavy storm in the spring and fall the creeks on this watershed do not rise so high as they do in the winter time when the surface of the ground is frozen, which indicates that during the greater part of the year the ground absorbs a large proportion of the water, a part of which percolates through the ground into the streams in a more or less filtered condition. On account of the flatness of the watershed and sparse population we believe that the supply of water obtained from this watershed will be as pure as any that can be obtained in the state. To maintain the purity of the water supply in the reservoir, the soil is being stripped from the surface of the ground which is to be flooded. We have already stripped a large part of the soil, and have used extraordinary care in excavating in the vicinity of buildings, so as to take off all traces of animal waste.

To take care of the objectionable drainage in the immediate vicinity of the reservoir site the Plymouth State road will be filled across the reservoir with a grade to the southwest so as to carry the surface drainage from the property of J. L. Myers to a ditch which we have constructed on the west side of Section 32, as indicated on the watershed map. This ditch also takes the objectionable drainage from the lands of John Breman and Andrew Deirmeyer.

The dam embankment was started on a drift deposit after the soil had been stripped. The dam has a top width of 38 feet, has side slopes of 2 feet horizontal to 1 vertical. The soil stripped from the south por-

tion of the reservoir is being deposited on the south side of the dam embankment which will add some strength to the dam embankment, and at the same time protect the dam embankment from being washed by the waters of the Sandusky river during the time of flood.

The dam embankment is being constructed of select clay which is being thoroughly sprinkled and well rolled as it is put in, so that when completed the embankment will be one of clay puddle. To protect it from the wash of the waves the inner slope of the dam embankment is being paved with boulders.

A substantial masonry weir 60 feet long has been constructed as shown on the blue print herewith presented. The length of 60 feet of weir was determined by computation on the assumption that the greatest maximum rainfall which could reach the reservoir would be one inch in one hour, and that the greatest desirable head that should come upon the weir would be one foot. The assumption that 1 inch of rainfall per hour would reach the reservoir was taken from the greatest fall of rain that has been observed in this vicinity, which is given by Mr. G. A. Hyde, voluntary observer for the United States Weather Bureau at Cleveland, 1.53 inches in 51 minutes, on August 15, 1887, as the greatest rainfall that had occurred within one hour for forty years prior to April 1, 1896.

The flow thus provided over the waste weir is amply safe both to protect the ground above us from being flooded, and to protect the dam from being washed out by high water.

The water will be delivered into a 14 inch supply pipe through the gate house which is constructed entirely of concrete from the top of the dam, and is 10 feet internal diameter, and 14 feet external diameter, having the bottom and walls constructed of concrete. A 16 inch pipe leads into the gate-house from the reservoir at the bottom of the gate-house. Then there are ten 8 inch pipe spaced 2.2 feet from center to center above the 16 inch pipe provided with valves so that water can be taken from any desired level.

The flow line of the reservoir is 26.4 feet higher than the floor of the pumping station of the Bucyrus Water Company.

When completed the reservoir will hold approximately 150,000,000 gallons of water, and will flood between 55 and 60 acres of land.

At a meeting of the Board held May 8th, 1900, Mr. F. P. Kahler, superintendent of the water works of Bucyrus being present, the plans for the proposed supply were considered. The Board voted to approve said plans but upon the condition that the water should be purified in a manner satisfactory to the State Board of Health whenever, in the opinion of that Board, such purification should become necessary.

REPORT ON ADDITIONAL WATER SUPPLY FOR CANTON.

In October, 1899, the superintendent of the water works of Canton asked the Board to approve of an additional supply of water for that city, to be obtained from a deep well located at the intersection of the Nimishillen creek and Navarre street.

An examination of the proposed supply indicated that the water was, at that time, of good quality. The Board adopted the following resolution in reference to approving said supply:

Resolved, That the Ohio State Board of Health sanctions the use of the water derived from the well at the intersection of the Nimishillen creek and Navarre street as an addition to the public water supply of Canton, Ohio. While the report of our chemist and bacteriologist, considered by itself, amply warrants such sanction, this Board, actuated by the desire to cooperate with the people of Canton in the securing of the best obtainable results, would encourage a farther exploration for underground water. If an equally pure water could be obtained at a point farther removed from the inhabited district, such a water should be preferred as an addition to the city's water supply.

Subsequently, the superintendent of the water works of Canton asked the Board to approve the use of deep wells located about one and one-half miles north of Canton as an additional source of the public water supply.

An examination of the proposed supply showed it to be of good quality and at a meeting of the Board, held May 9th, 1900, it was voted to approve the use of these wells.

Neither of these proposed sources of additional supply have been put in use.

REPORT ON IMPROVEMENTS IN THE PUBLIC WATER
SUPPLY OF CONNEAUT.

In the last annual report of the Board a report is made of an investigation of an outbreak of typhoid fever at Conneaut, which seemed to show that the pollution of the public water supply, obtained from Lake Erie, was very largely responsible for the disease. It was recommended that filters be introduced to purify the supply. Mr. Frederick C. Howe, Esq., receiver for the Conneaut Water Works and Supply Company, presented plans for the filtration of the water supply of Conneaut to the Board and requested their approval. The plans provided for the installation of what is known as a Jewell, high duty, gravity filter plant, the same to consist of two subsiding tank, gravity filters, each to be 16 feet 6 inches outside diameter by 16 feet in height. It was agreed upon the part of the Jewell Filter Company that the two filters proposed should have a yearly capacity to deliver, jointly, one million

gallons of filtered water per day of twenty-four hours. A further guarantee was given of a bacterial reduction averaging ninety-seven (97) per cent. when the two filters are operating at the rate of a yearly average capacity of eight hundred thousand (800,000) gallons per day of twenty-four hours and when the number of bacteria in the raw or unfiltered water is in excess of seven thousand (7,000) per cubic centimetre, and that the number of the bacteria in the filtered water shall average not more than two hundred (200) per cubic centimetre when the number of bacteria in the raw or unfiltered water is less than seven thousand (7,000) per cubic centimetre; and that, when the two filters are operated at the rate of a yearly capacity of eight hundred thousand (800,000) gallons per day of twenty-four hours, the filtered water will be bright and clear, practically free from suspended matter and color visible to the naked eye and well suited to domestic use.

These plans were submitted to the Board and it was voted to approve them, notice of which action was duly sent to Mr. Howe, as receiver for the Conneaut Water Works and Supply Company, November 23, 1899.

REPORT ON PROPOSED WATER SUPPLY FOR CUYAHOGA FALLS.

Dr. Chapman as a committee, with the engineer, visited Cuyahoga Falls on September 18th, 1900, investigated the proposed supply and made the following report:

The village has an estimated population of 4,000. It is situated on both sides of the Cuyahoga river, into which its drainage goes. There are no sewers as yet, except a few private ones from buildings along the river.

For the public water supply bonds for \$5,000 have been issued and \$45,000 more are to be issued as soon as the plans are completed. It is proposed to obtain the water from a bed of sandstone, which underlies the whole community, at a point in the northeastern part of the village between the C. A. & C. and the P. & W. Railroad tracks, and near the Cuyahoga river. The only pollution to be found near the site is that due to three or four houses, the nearest of which is about fifty yards from the water works wells.

One 6-inch well has been drilled 74 feet deep, 20 feet of it through a close yellow sandstone and the remainder in the white water-bearing sandstone, the bottom of the well just reaching a black shale. The normal level of the water is 15 feet from the surface, about 5 feet above the river level, and pumping for twenty-four hours at the rate of 3,000 gallons per hour lowered the water level about 5 feet. An 8-inch

well is being drilled thirty feet from the first one so as to study the influence of one well on the capacity of the other. From the results of this test the number of wells necessary will be determined, also the proper distance apart to locate them. It is thought that five wells will furnish a sufficient supply for some time. It is proposed to put in a storage cistern near the wells for a reserve supply, but ordinarily to pump the water direct from the wells to a standpipe.

From the depth at which the water is to be obtained and from the character of the covering it is probable that the water will not be greatly affected by surface conditions, although some of the surface organic matter may find its way to the lower waters, but only in a transported form. The chemist reported upon a sample of the water as follows:

RESULTS OF CHEMICAL EXAMINATION OF WATER FROM CUYAHOGA FALLS.

PARTS PER MILLION.

Number of sample.....	1377
Color .....	.05
Turbidity	none
Sediment	none
Odor	none
Oxygen required .....	.88
N. as ammonia free .....	.006
N. as ammonia albuminoid .....	.036
N. as nitrates	10.20
N. as nitrites	trace
Chlorine	17.3
Alkalinity	70.3
Incrusting constituents	61.0
Total solids	260.
Volatile and combustible	95.

"The sample was received September 21st, having been collected by L. E. Chapin and Orlando Wilcox, and is from a well proposed as a supply. In physical properties and freedom from organic matter this is an excellent water. It is also desirable because it is comparatively soft water. The chlorine and nitrates under ordinary circumstances would be taken as indicative of past pollution, but if, as reported, this water had its origin in the same stratum as the Massillon water, then it is entitled to have a considerable chlorine from mineral sources. Again, as it is stated that there is no source of pollution in the neighborhood of the well, and thus did the chlorine and nitrates stand for organic pollution, the source must be so remote in distance as to give ample time for thorough purification. The great freedom of the sample from organic matter shows the thoroughness of the purification, and such a water, if introduced as a public water supply, ought to prove very satisfactory to the consumers."

The report of the chemist shows the water to be of a good quality and the committee recommended that the supply be approved upon the condition that the present purity be maintained by the prevention of local pollution and by such other means as may be necessary.

The Board voted to approve the source of this public water supply upon the conditions mentioned in the committee's report, and the water works trustees were so notified October 6, 1900.

REPORT ON PROPOSED CHANGES AND ADDITIONS TO THE PUBLIC WATER SUPPLY OF DAYTON.

The city of Dayton was authorized to spend \$170,000 in improving and extending its public water supply, and called upon the State Board of Health to approve plans.

Dr. Stanton and the secretary, as a committee, visited Dayton April 3rd, 1900, inspected the water works plant, and examined the territory within which new wells were to be placed. They reported as follows:

The present water supply of Dayton is obtained from eighty-seven driven wells extending along the bank, and partly within the bed of Mad river. The wells are located near the pumping station, which is within corporate limits. The present system was introduced in 1887, and it is said that when these wells were first put down they overflowed at the rate of about five million gallons per day. At the present time these wells do not overflow. The wells are eight inches in diameter and vary in depth from forty to sixty-two feet. In some places a layer of clay is found above the water-bearing gravel which furnishes the supply, but in other places this clay layer is absent. Three test wells were put down in the new territory which it is proposed to develop, if necessary. These wells are seven hundred feet from the last one of the group of wells belonging to the present system. In testing these wells two of them were pumped continuously for twenty-four hours, the rate of pumping not having been noted, and with the effect of lowering the water in the other well, kept open for observation, but eleven inches. The average daily supply of water pumped at the present time is about five and one-half million gallons. On one occasion water was pumped at the rate of sixteen and one-half million gallons for twenty-four hours. No provision is made for storage, the water being pumped direct to consumers. No sewage enters the river above the location of the wells, but there is some storm water reaching the river at various points above them. The pumping station and the wells now in use are upon the left bank of the river. There are no dwellings or other sources of contamination in the immediate vicinity of these wells. On the other side of the river the territory is well built up, and privy vaults, which are not connected, are in general use. There is also on this side of the river a

short distance above the wells a large strawboard works, which discharges its waste into the river. This discharge is just below a dam in the river, and it is stated that during the summer months when the flow of the river is but slight, the water of the river becomes badly polluted. The history of Dayton's water supply since 1887 has been good, and apparently there has been no contamination of the water. It is now proposed to put in a new main with which the various wells are to be connected. This main will be below low water mark in the river, starting at a depth of twelve feet and reaching a depth of twenty-three feet at its upper end. It is believed by the water works board that the introduction of this new main will enable them to increase their supply from the present system of wells, but if it should become necessary they desire to put down new wells farther up the river in the neighborhood of the three test wells referred to above.

Samples of water were collected for chemical examination, one from one of the test wells, and the other from one of the wells now in use, the one nearest the central part of the city.

RESULTS OF CHEMICAL EXAMINATION OF WATER FROM DAYTON.

PARTS PER MILLION.

	Lower wells 1007	Upper wells 1008
Number of sample		
Color	trace	trace
Turbidity	none	none
Sediment	none	trace
Odor	faint chalky	faint chalky
Oxygen required .....	.93	.62
N. as free ammonia .....	.004	.005
N. as albuminoid ammonia .....	.024	.018
Nitrogen as nitrates	2.56	1.96
Nitrogen as nitrites	none	trace
Chlorine	3.7	5.7
Alkalinity	240.6	253.4
Incrusting constituents	58.4	56.2
Total solids	380.	366.
Volatile and combustible	61.	41.

The committee recommended that the proposed changes of and additions to the Dayton water supply be approved, and the Board voted to approve the plans, as indicated in the foregoing report. Notice of the Boards action was sent to the water works trustees of that city April 19th, 1900.

REPORT OF A TEST OF MECHANICAL FILTERS AT DENNISON.

The State Board of Health approved of the introduction of mechanical filters to improve the water supply of Dennison and Uhrichsville. These two cities have a common water supply.

At the request of the company a test was made after the installation of the filters to determine their efficiency. The engineer and bacteriologist of the Board visited Dennison, April 11th, 1900, and made the following reports:

REPORT OF THE ENGINEER.

The filter plant was visited on April 11th and the following information gathered in reference to same:

The raw water is admitted from Stillwater creek to a settling basin of about 400,000 gallons capacity, flows from here to a small suction well, where the alum is admitted, and is then pumped onto the filters by a horizontal, duplex, Worthington pump of 1,000,000 gallons nominal capacity, but of greater capacity now on account of the low head. From the filters the water flows through a concrete flume to the clear water well, from which it is pumped to the distributing reservoir by a horizontal, compound, duplex Holly pump of 2,000,000 gallons capacity.

There are four standard, 16-foot Jewell gravity filters, each of which has a filter bed fifteen feet in diameter and four and a half feet deep, and composed of the Jewell Company's natural sand from Red Wing, Minn. The area of each filter is 176.71 square feet, making 706.84 square feet for the four filters, or .016 acres.

The coagulant used is block crushed alum from the Pennsylvania Salt Company.

Owing to the fact that the plant had been but recently installed, in January, 1900, the arrangements for handling the alum had not been perfected and it was impossible to accurately measure the quantity used. On this account the following table was prepared and the average result for a short period found:

Date.	Revolutions of pump.	Gallons pumped.	Pounds of Alum used.	No. of filters washed.	Turbidity of creek.
April 1	45,990	1,563,660	175	4	.302
April 2	47,645	1,619,930	350	6	.530
April 3	44,800	1,523,200	175	8	.400
April 4	45,190	1,536,460	350	8	.222
April 5	27,590	938,060	.....	4	.180
April 6	46,490	1,580,660	175	8	.145
April 7	43,929	1,493,586	.....	2	.132
April 8	47,531	1,616,054	175	4	.158
April 9	36,360	1,236,240	.....	6	.170
April 10	45,400	1,543,600	175	2	.178
April 11	46,880	1,593,920	175	2	.155
Total	477,805	16,245,370	1,750	54	.....
Average	43,437	1,476,852	159.09	5	.234

The quantity of water pumped was obtained by multiplying the number of revolutions by 34, which gives the total number of gallons pumped with an allowance of 12 per cent. for slip. The slip, as obtained by an engineer in the employ of the company, was 10.55 per cent. with the pumps newly packed, and the above figure was assumed as being nearly correct for ordinary conditions.

The amount of alum was obtained from the record book of the pumping engineer, in which are put down the time of filling the tanks and the amount put in each. As seen, this record shows only the amount of alum made up each day and is valuable only when used for a period of several days.

The table shows also the number of filters washed each day and the turbidity of the creek as determined by Hazen's method.

The average daily consumption for the period of eleven days was 1,476,852 gallons, during which time 1,113,636 grains of alum were used or an average of 0.75 grains per gallon. The average rate of filtration for the eleven days was 92,303,000 gallons per acre per day, which is well within the limit of 120,000,000 gallons. If there had been but three tanks installed, the average rate for these 11 days would have been 123,000,000 gallons per acre per day and this at a period of low consumption.

The effluent is excellent, as far as appearance goes and is giving general satisfaction to the patrons of the company.

REPORT OF CHEMIST AND BACTERIOLOGIST.

RESULTS OF CHEMICAL AND BACTERIOLOGICAL EXAMINATION OF WATER FROM DENNISON.

PARTS PER MILLION.

	Creek.	Sed. basin.	Combined effluent.	Yard hydrant.	Reservoir.	Tap water July, 1899.
Number of sample.....	1029	1030	1035	1036	1037	578
Color.....	.30	.28	none	.10	.08	.20
Turbidity.....	.15	.12	none	none	none	.12
Sediment.....	slight	slight	none	none	none	slight
Odor.....	earthy	earthy	none	none	none	earthy and trace veg.
Oxygen required.....	2.34	2.11	1.08	1.41	1.38	3.84
N. as ammonia free.....	.024	.026	.014	.012	.013	.002
N. as ammonia albuminoid..	.110	.100	.036	.070	.080	.153
N. as nitrates.....	.73	.73	.79	.94	.80	.03
N. as nitrites.....	.002	.002	trace	trace	trace	.003
Chlorine.....	1.2	1.3	1.3	1.1	1.1	1.6
Alkalinity.....	82.0	91.2	70.8	81.0	80.8	105.
Incrusting constituents.....	5.8	10.2	38.0	27.0	17.0	32.8
Total solids.....	189.	198.	178.	161.	154.	267.
Volatile and combustible ...	45.	55.	46.	42.	37.	67.
Bacteria per c. c.....	4000.	3600.	152*.	600.	750.	267.

* Computed by taking average of four effluents.

The improvement in the bacterial character of the water as a result of the filtration process is also accompanied by the removal of other undesirable material, as shown by the chemical analyses. The creek water was objectionable in appearance while the effluents were all faultless in their physical properties, and the removal of organic matter was satisfactory, as seen from the chemical findings, which are those of a satisfactory, potable water.

Under the arrangement at the plant, the amount of alum used was not definitely gauged, but the operators estimated the amount used as two grains per gallon. Our results show the estimate was approximately correct, as but slightly more alum than that was employed.

The use of alum causes a decrease in the alkalinity and a corresponding increase in the incrusting constituents, hence there is no undecomposed alum in an effluent unless the alkalinity has disappeared. In the present tests there was absolutely no free alum in the effluent, as may be seen from the table which follows, and, furthermore, the data obtained at this time and in our 1899 river work on Big Stillwater indicates that the alkalinity of the water in that stream probably never reaches a stage low enough but that it would be amply able to decompose much more sulphate of alumina than is demanded legitimately by the process of filtration in use. The lowest alkalinity we have obtained from Big Stillwater creek was on May 31, when the finding was 47.1 parts per million. As a soft water the effluent from the filters of the Dennison Water Supply Company ranks with the softest public supplies of the state.

The hydrant and reservoir samples were taken in order to determine the character of the water actually supplied to consumers at that time, April 12. The results from the hydrant and reservoir samples are practically the same, and on comparing them with the effluent we find their oxygen requirement, albuminoid ammonia, and number of bacteria higher than in the effluent, which indicates that the reservoir and distribution system still contains some vegetative material — a fact not causing any surprise in view of the vegetative character of the water formerly conveyed to reservoir.

A comparison of the hydrant water with the sample taken from the Parker House in July, 1899, shows that the water furnished to consumers in April, 1900, was much improved as regards the amount of vegetative, organic material contained, and that its physical properties were also greatly improved, although the bacteria were more numerous in the sample last taken. Number 578 is about on a par with the better samples obtained at the intake in Big Stillwater creek during our 1899 river work.

The following table shows the alkalinities and incrusting constituents obtained in this test :

No. of test.	Source.	Alkalinity.	Incrusting constituents.
1	Creek	87.0	14.2
2	Basin	87.2	16.0
3	Pump	77.2	30.0
4	Flume	75.4	46.8
5	Creek	87.8	16.4
6	Basin	87.4	18.4
11	Flume	78.0	36.8
12	Flume	74.6	37.2
19	Creek	92.0	5.8
20	Basin	91.2	10.2
25	Combined effluent	70.8	38.0

The following table shows the number of bacteria in the filtered and unfiltered water, the reduction and the percentage of efficiency.

No. of test.	No. of sample.	Date.	Hour.	Source.	Bacteria per c. c. unfiltered.	Bacteria per c. c. filtered.	Reduction per c. c.	Efficiency per c. c.
1	1011	April 11..	3:12 p. m.	Creek	2700	.....	.....	.....
2	1012	" 11..	3:19 "	Sed basin	2200	.....	500	18.5
3	1013	" 11..	3:25 "	Pump	2000	.....	700	25.9
4	1014	" 11..	3:35 "	Flume	2700	170	2530	93.7
5	1015	" 11..	5:15 "	Creek	5300	.....	.....	.....
6	1016	" 11..	5:20 "	Basin	3600	.....	1700	32.1
7	1017	" 11..	6:00 "	No. 1 effluent..	5300	425	4875	92.0
8	1018	" 11..	5:40 "	" 2 "	5300	375	4925	92.9
9	1019	" 11..	5:45 "	" 3 "	5300	190	5110	96.4
10	1020	" 11..	5:48 "	" 4 "	5700	350	4950	93.4
11	1021	" 11..	6:10 "	Flume	5300	550	4750	89.6
12	1022	" 11..	8:10 a. m.	"	5200	325	4875	93.1
13	1023	" 12..	8:20 "	Creek	5200	.....	.....	.....
14	1024	" 12..	8:25 "	Basin	5100	.....	100	1.9
15	1025	" 12..	8:40 "	No. 1 effluent..	5200	150	5050	97.1
16	1026	" 12..	8:41 "	" 2 "	5200	170	5030	96.7
17	1027	" 12..	8:43 "	" 3 "	5200	190	5010	96.3
18	1028	" 12..	8:35 "	" 4 "	5200	250	4950	95.2
19	1029	" 12..	9:40 "	Creek	4000	.....	.....	.....
20	1030	" 12..	9:45 "	Basin	3600	.....	400	10.
21	1031	" 12..	9:50 "	No. 1 effluent..	4000	150	3850	96.2
22	1032	" 12..	9:55 "	" 2 "	4000	170	3830	95.8
23	1033	" 12..	10:03 "	" 3 "	4000	160	3840	96.0
24	1034	" 12..	10:05 "	" 4 "	4000	130	3870	96.8

These results furnish the following table of averages:

Source.	Numbers of tests.	Average number of bacteria.	Reduction per c. c.	Efficiency.
Creek	1, 5, 13, 19	4300	.....	.....
Sed. basin.	2, 6, 14, 20	3625	675	15.7
Effluent from flume.	4, 11, 12	348	3952	92.0
Effluent filter No. 1.	7, 15, 21	242	4058	94.4
Effluent filter No. 2.	8, 16, 22	238	4062	94.7
Effluent filter No. 3.	9, 17, 23	180	4120	95.8
Effluent filter No. 4.	10, 18, 24	243	4057	94.3

The individual effluents were not tested at 3 o'clock on the first day, as there was no way of obtaining the effluent separately. At the time a machinist was telephoned for and the effluent pipe of each filter was tapped and a pet-cock inserted. The 6 o'clock tests of the first day were made, therefore shortly after this disturbance, and since these pet-cocks were more or less greasy and dirty, it is only fair to say that doubtless a number of bacteria in tests 7 to 10 were higher than they would otherwise have been. The morning results were better and should be taken as representative of the normal conditions. The mean of the two sets of tests made on the morning of April 12th give the following number of bacteria per c.c. in the effluents: No. 1, 150; No. 2, 170; No. 3, 175; No. 4, 190. These numbers are below 200 per c.c., which is the limit (when the raw water does not contain more than 7000 bacteria per c.c.) allowed by the contract between the Dennison Water Supply Company and the O. H. Jewell Filter Company. The efficiency is not equal to that which has been obtained in other filters constructed by the same makers.

The flume is so situated that it received the drippings when water fell upon the floor covering the flume, consequently drippings took place when the pipes were tapped for the insertion of the pet-cocks, but such an influence is not at work normally since there is little or no traffic on that floor under the usual conditions. The number of bacteria in the combined effluent, as found in the flume, was 170 when we first reached the plant on the afternoon of April 11th, while it rose to 550 at the time of the greatest dripping and then fell again to 325 the next morning.

None of the effluent samples contained intestinal bacteria nor even any gas-forming organisms. The raw water did contain gas formers, but the search was not continued to see if intestinal forms were present, owing to the rush of other work.

The bacteriologist again visited Dennison June 12th, and the following report will give the results of further examinations:

RESULT OF CHEMICAL AND BACTERIOLOGICAL EXAMINATION OF WATER FROM
DENNISON.

PARTS PER MILLION.

	Raw water.	Effluent.
Number of sample	1150	1151
Color .. . . . . .	.30	.12
Turbidity .. . . . . .	.38	none
Sediment	considerable	none
Odor	vegetative	none
Oxygen required	5.72	2.08
N. as ammonia free .. . . . . .	.062	.037
N. as ammonia albuminoid .. . . . . .	.186	.093

RESULT OF CHEMICAL AND BACTERIOLOGICAL EXAMINATION OF WATER FROM
DENNISON — Concluded.

PARTS PER MILLION.

	Raw water.	Effluent.
Nitrogen as nitrates .....	.33	.36
Nitrogen as nitrites.....	.032	none
Chlorine .....	.6	1.1
Alkalinity	99.0	71.0
Incrusting constituents.....	none	none
Total solids	305.	225.
Volatile and combustible.....	97.	84.
Bacteria per c. c.	4160	66 (computed)

No. of test.	No. of sample.	Date.	Hour.	Source.	Bacteria per c. c. unfiltered.	Bacteria per c. c. filtered.	Reduction per c. c.	Efficiency per c. c.
1	1145	June 12...	6:26 p. m.	Creek	4040	.....	.....	.....
2	1146	" 12... 6:31 "	"	No. 1 effluent...	4040	75	3965	98.1
3	1147	" 12... 6:32 "	"	" 2 "	4040	44	3996	98.8
4	1148	" 12... 6:34 "	"	" 3 "	4040	70	3970	98.3
5	1149	" 12... 6:35 "	"	" 4 "	4040	65	3975	98.4
6	1150	" 12... 8:00 "	"	Creek	4160	.....	.....	.....
8	1152	" 12... 8:12 "	"	No. 1 effluent...	4160	48	4112	98.8
9	1153	" 12... 8:14 "	"	" 2 "	4160	60	4100	98.6
10	1154	" 12... 8:15 "	"	" 3 "	4160	65	4095	98.4
11	1155	" 12... 8:17 "	"	" 4 "	4160	90	4070	97.8
13	1157	" 13... 7:30 a. m.	"	" 1 "	4100	100	4000	97.6
14	1158	" 13... 7:32 "	"	" 2 "	4100	85	4015	97.9
15	1159	" 13... 7:34 "	"	" 3 "	4100	42	4058	99.0
16	1160	" 13... 7:36 "	"	" 4 "	4100	65	4035	98.4
18	1162	" 13... 9:11 "	"	" 1 "	4100	55	4045	98.7
19	1163	" 13... 9:12 "	"	" 2 "	4100	60	4040	98.5
20	1164	" 13... 9:13 "	"	" 3 "	4100	42	4058	99.0
21	1165	" 13... 9:15 "	"	" 4 "	4100	55	4045	98.7

As the creek water was not being admitted to the sedimentation basin on the second day of the test, the number of bacteria per c. c. in the raw water on the first day serves as the basis for computing the efficiency.

The above figures furnish the following table of averages:

Source.	Number of tests.	Average number of bacteria.	Reduction per c. c.	Efficiency.
Creek	1, 6	4100 per c. c.	.....	.....
Effluent Filter No. 1.....	2, 8, 13, 18	70	4030	98.3%
" No. 2	3, 9, 14, 19	62	4038	98.5%
" No. 3.....	4, 10, 15, 20	55	4045	98.7%
" No. 4.....	5, 11, 16, 21	69	4031	98.3%

These averages are quite satisfactory and show the filters have a good bacterial efficiency. None of the effluent samples taken contained intestinal bacteria nor even any gas-producing organisms, while each of the raw waters contained gas producers, but whether they belonged to the group of intestinal bacteria was not determined owing to the lack of time.

The chemical analyses show a marked improvement in various features, but some of the differences in the mineral characters are not to be ascribed solely to the process of filtration.

More alum was being used at the time of the evening samples than on the next morning, but as the following determination for the alkalinities show there was at no time an amount of alum used that would require for its decomposition anything like the alkalinity of the raw water. There was no undecomposed alum in any of the effluents, and the lowest alkalinity obtained in an effluent was 69.0 parts per million.

Test.	Source.	Alkalinity in parts per million.
1	Creek	101.0
2-5	Combined effluent	69.0
6	Creek	99.0
7	Combined effluent.....	71.0
12	Creek	102.0
13-16	Combined effluent.....	86.0
17	Creek.....	100.0
18-21	Combined effluent	87.0

These findings show the effluent to be a good potable water, suitable for drinking and other domestic purposes.

REPORT ON THE PROPOSED WATER SUPPLY FOR FORT RECOVERY.

The village of Fort Recovery having made application for the Board's approval of a proposed water supply, Dr. Warner and Mr. Flynn, engineer, were appointed a committee to make the necessary investigation. The committee visited Fort Recovery on July 19th, 1900, went over the proposed supply in company with the mayor and members of council, and reported as follows:

Fort Recovery is a village with some 1,000 inhabitants who are supported by the agricultural interests of the neighboring community and by large lumber interests. On the 27th of February, 1900, this village voted to issue bonds for \$30,000, twenty thousand dollars of which was

to be for water works and ten thousand dollars for electric lights. It is the intention to put the plants together in one building so as to economize in construction and in cost of operation. The water is to be pumped from wells to an elevated tank of such capacity as will allow all pumping to be done at night, after the maximum load is off the electric plant.

The supply which this village wishes to have approved is obtained from two wells located on a lot almost in the center of the village. The reason for the selection of this location was that this lot was owned by the village, it having been formerly used as the site for the jail. The lot is 82.5 by 165 feet, and is surrounded by the scattered population found in a place of this size, with their accompanying outhouses, barns, etc. The lot is very low, much below the neighboring street levels, and it is drained by a small run flowing through it. Next to the lot in question is a flour mill with its attending piles of refuse, especially large quantities of sawdust which is used for fuel.

The wells occupy opposite corners of the lot, making them 170 feet apart. They are 8 inches in diameter and 208 and 214 feet deep respectively. The strata pierced by the wells consists of a few feet of soil, about 35 feet of blue clay, 75 feet of quicksand and gravel, then white limestone, and finally a blue limestone in which the water is found. This makes the wells from 93 to 99 feet in the bed of the rock. The water stands normally only five feet below the surface and pumping at a rate of 200 to 400 gallons a minute lowered it only 20 feet, indicating an abundance of water.

Samples of water were collected from these wells July 23, and examined by Mr. Horton, our chemist, who reported as follows:

RESULTS OF CHEMICAL EXAMINATION OF WATER FROM FORT RECOVERY.

PARTS PER MILLION.

	Well No. 1.	Well No. 2.
Number of sample	1248	1249
Color . . . . .	.12	.16
Turbidity . . . . .	.16	.14
Sediment	considerable	considerable
Odor	woody	woody
Oxygen required	1.24	1.17
N. as Ammonia free . . . . .	.364	.400
N. as Ammonia albuminoid . . . . .	.094	.100
Nitrogen as nitrates	trace	trace
Nitrogen as nitrites	none	none
Chlorine	12.5	17.2
Alkalinity	210.0	206.2
Incrusting constituents	211.4	213.6
Total solids	1565.	1516.
Volatile and combustible	366.	340.

"The analytical findings show these waters to be quite similar and they may be discussed together. The high free ammonia in these waters from deep wells is due to the reduction of the nitrates, and of course it is not to be taken as indicative of sewage pollution; neither is the amount of chlorine present to be considered as a sewage indicator, for it comes legitimately from the strata washed by the water in that locality. In organic purity the waters are passably good, although the amount of albuminoid ammonias might be less in deep well waters.

In the physical properties the samples do not rank so well; the appearance would give rise to complaint from the consumer as there is a marked sediment and turbidity.

However, the greatest objection to these waters rests on their strong mineral characters. Both are very hard waters, and in both the amount of sulphates is great. Either water would be objectionable for laundry and boiler purposes, and would probably prove unsatisfactory for some household uses. These samples are somewhat akin to the Celina water. (See page 202, Public Water Supplies, 1897-8.)"

The character of the water as shown by the chemical analyses is not objectionable organically, although the albuminoid ammonia is high, but it is not satisfactory for a public water supply when its mineral constituents are considered. This latter feature probably could not be bettered in this locality, especially if a deep-seated water is used. No attempt seems to have been made to obtain a subsurface supply in a locality removed from local pollution.

It is difficult in this case to determine what is best for the welfare of the village, especially since so much has been done already. If a new supply should be required, removed from the objectionable surroundings of the present one, it will require considerable extra piping and wiring owing to the wide limits of the village, so much that the present bond issue would probably not be sufficient for the work and the success of the scheme endangered. This would be unfortunate as the proposed supply is much better than that from the private wells, most of which are very shallow and much more liable to be polluted than the deep ones in question. Notwithstanding this it is very undesirable to allow the village to carelessly locate wells for a public water supply in the very center of the populated area and with such objectionable surroundings as these wells have.

Considering all phases of this question, your committee respectfully recommends that the supply be approved with the following conditions:

First. That the small run through the water works lot be carried through the same in a water-tight sewer of such dimensions as will care for the storm flow of said run, and that lateral drains be run to this sewer from both sides of the lot so as to effectually drain same and carry off the objectionable surface and subsurface drainage in the vicinity of the proposed water works.

Second. That the plans for this work be submitted to the Board for approval.

Third. That the purity of the water be maintained to the satisfaction of the State Board of Health by proper protection of the well site, the removal of all sources of pollution and by such other means as are necessary.

Your committee further wishes to state that it deplors the tendency of the smaller villages of the state to spend considerable sums of money for developing a new water supply, without first securing proper advice and assistance in determining the advisability of using the same; and that motives entirely foreign to the main issue of securing a potable water often decide the question of the source of the new supply.

The officials of Fort Recovery should further understand that, if this supply is approved and the water works is installed, extreme precautions must be taken to protect the supply, and that it may be necessary at some future time to secure water more remote from the center of the village, especially if it be found that the present supply is being influenced by surface pollutions. The present freedom from pollution is due to the impervious covering of clay over the water-bearing strata and under no circumstances should this be permitted to be punctured with cesspools or vaults.

The council having agreed to the conditions for approval as recommended by the committee, the Board voted to approve the proposed supply, notice of which action was sent to the mayor and council of Fort Recovery, August 6th, 1900.

INVESTIGATION OF THE WATER SUPPLY OF GALION.

The Board of Health of Galion requested the State Board of Health to make an investigation of the condition of the public water supply of that city, it being feared that water at times was being taken direct from Whetstone creek, a small stream unfit for domestic use. Accordingly the engineer was sent to Galion to make an examination of conditions there and he reported as follows:

The Galion water works was put in about 1882-3 by a private company operating under a ten-year contract, which was renewed in 1894 for ten more years. The franchise gives elaborate directions concerning the amount of water, fire hydrants, rates, etc., but nothing regarding the kind of water to be supplied.

The plant at present consists of 14 driven wells, one infiltration well, intake pipe, and two tile intakes or feeders, a brick pumping station with two horizontal, duplex, Deane pumps of 1,500,000 gallons capacity each, a small air-pump, and suitable boiler capacity, an elevated tank, total height 166 feet, capacity 155,000 gallons, and 12 miles of mains with 430 taps, of which 40 are metered.

The average daily consumption is from 300,000 to 400,000 gallons, or a consumption per consumer of from 120 to 160 gallons per day.

The original supply was from the large infiltration well, which is 28 feet deep and 28 feet in diameter, lined with brick and housed over. This well is about 500 feet from the Whetstone creek or Olentangy river, and is sunk through 25 feet of soil, gravel and blue clay into a layer of sand and gravel. It seems that this well began to fail and an 8-inch tile was laid from the creek to a crib about 30 feet from the well. Later another well was put down about 100 feet from the creek, but this is now caved in and abandoned. About 1891 the company began to put in driven or drilled wells and has put in 14 to date. Four of these wells are eight inches in diameter and the remainder are six inches in diameter, and they range from 45 to 90 feet in depth, going through soil and gravel, blue clay, gravel and sand, soft shale, gravel, and the deeper ones getting into the limestone about 70 feet down. These wells soon failed to give enough water and a second line of tile was laid last year from the creek to a small crib within 30 feet of one of the deep wells in an attempt to increase the supply from this source. A 4-inch pipe leads from the creek to the pumping station, which it is claimed was used only for boiler supply, but not used at all now.

The water stands from 20 to 22 feet from the surface in all the wells and it can easily be pumped down the suction limit of the pumps, or about 38 feet from the surface. The pumps are set down seven feet.

On the day of the inspection, March 3rd, 1900, the stand pipe was out of use and the large pumps were supplying the city direct from 12 of the deep wells. The small airlift was testing one of the deep wells, pumping it to the infiltration well. It was stated that the well was giving 200,000 gallons in 12 hours.

The infiltration well contained six and one-half feet of water. It had been receiving the discharge from the air lift for six days and had not been pumped for two days, as the valve in the suction pipe was stuck.

The company intends to install a large air compressor and air lifts for several of the wells, hoping thereby to increase their supply sufficiently to keep pace with the consumption.

Consulting with the health officer and a local physician, it was found that the complaint was due to the muddiness and bad odor and taste of the water. The water works engineer says that this is caused by the stirring up of the rust in the pipes by the change in pressure, and the public claim that it is due to the admission of water from the creek. At the time of inspection no surface water was being admitted direct, but it is not impossible to do so, and much may be admitted indirectly through the tiles leading from the creek to the gravel beds which supply the wells.

Chemical and bacteriological samples were taken from the following sources:

Sample No. 1. Discharge of air lift from 6-inch well 70 feet deep. This is an old well being tested to determine the capacity with this method of pumping.

Sample No. 2. Infiltration well. This water is a mixture of that naturally entering the well and of the water being pumped in by the air lift. (Sample No. 1.)

Sample No. 3. Discharge of pump which was drawing by direct suction from 12 deep wells. On this day same as tap water.

Sample No. 4. Whetstone creek or Olentangy river opposite the water works. Contains surface drainage of Galion and some sewage.

The last sample was taken for comparison with the others so as to determine the influence of the creek and to throw further light upon the question of whether any of it is used directly or indirectly.

RESULTS OF CHEMICAL AND BACTERIOLOGICAL EXAMINATIONS OF WATER FROM GALION.

PARTS PER MILLION.

	No. 1.	No. 2.	No. 3.	No. 4.
Number of sample....	965	966	967	968
Color .....	.1	.15	.12	.28
	Less than	Less than	Less than	
Turbidity .....	.06	.06	.06	.65
Sediment	trace	trace	trace	considerable
Odor.	none	ft. earthy	none	bad—swampy
Oxygen required .....	.78	1.51	1.19	11.80
N. as free ammonia .....	.518	.184	.250	.476
N. as albuminoid ammonia..	.032	.090	.042	.0566
N. as nitrates .....	.08	1.68	1.36	1.15
N. as nitrites	none	.004	.003	.016
Chlorine	5.2	18.4	18.7	11.2
Alkalinity.	267.6	285.6	302.0	81.6
Incrusting constituents	59.2	379.4	275.4	57.8
Total solids	515.	1212.	987.	376.
Volatile and combustible ..	113.	307.	285.	105.
Iron	1.6	.7	.8	2.5
				unfiltered

No. 960 and 965. "No. 1, air-lift discharge from driven well."

No. 961 and 966. "No. 2, infiltration well."

No. 962 and 967. "No. 3, from 12 driven wells."

No. 963 and 968. "No. 4, Whetstone creek."

No. 960 contained 22 bacteria per c. c. Colon bacilli were not found.

No. 961 contained 3100 bacteria per c. c. Colon bacilli were not found.

No. 962 contained 170 bacteria per c. c. Very few suspicious organisms found.

No. 963 contained 35800 bacteria per c. c. Colon bacilli present.

"All of the samples were collected by Mr. Flynn on March 3rd, but the chemical samples were shipped by express, and were not delivered until late on the 5th. Many of the determinations were not in accordance with the results expected from the information given Mr. Flynn, and

therefore these determinations were repeated, but the findings in all cases were identical with the first analyses.

The results are best considered under certain heads, as follows:

1. Influence of Whetstone creek.

(a) On samples Nos. 966 and 967, i. e., on the infiltration well and the 12 driven wells. In 966 and 967 the findings for nitrates, chlorine, alkalinity and incrusting constituents are so much greater than in the creek water as to point strongly to the presence of considerable subsoil water in the wells and but little creek water from the tiles and cribs, unless it should be the case that the soil water is extremely high in these particulars. The findings for oxygen requirement and ammonia are so much higher in the creek than in the water of the wells as to show a good filtration of the creek water in case any appreciable amount of it is entering the wells, but as stated above the results indicate but a small portion of creek water in the wells.

(b) On the driven well pumped by an air-lift. The water of this well is similar to that from Whetstone only in its free ammonia and incrusting constituents, and the former of these is evidently due to reduction of nitrates and thus has no relation to the ammonia of the creek. In the face of the other differences between samples 965 and 968, especially in chlorine and alkalinity, the similarity in incrusting constituents has but little weight, and we must conclude that there is no evidence that the air-lift well was drawing from the creek.

2. Influence of the air-lift well on the infiltration well. Mr. Flynn was informed that this driven well was being pumped by an air-lift into the infiltration well at the rate of 200,000 gallons in 12 hours; that it had been so pumped for six days; and that no water had been drawn from the infiltration well for two days. Under these conditions one would expect the water in the infiltration well to have been largely derived from the air-lift well, and to yield on examination results quite similar to the water from the air-lift. I can not interpret the two sets of figures so as to show a large proportion of air-lift water in the infiltration sample. Comparing the findings of 965 and 966, it could be said that the increase of oxygen required, albuminoid ammonia, and nitrates in the infiltration water might be due to some surface influence, but the marked increase in chlorine, nitrates, and especially incrusting constituents, together with the decrease in free ammonia in that sample is an inigma to me under the conditions as stated by Mr. Flynn. The analytical results would indicate the presence of much subsoil water in the infiltration well and but little water from the air-lift.

3. Comparison of the air-lift water with the water of the other wells. It seems that the air-lift well draws its water from a deeper source than the other wells and the difference between the waters is seen in the higher nitrates, chlorine, and incrusting constituents of the water

from near the surface as found in the infiltration well and the combined production of the twelve driven wells. (None of these wells could be pumped lower than 38 feet below the surface. See Engineer's report.) As the air-lift well is surrounded by some of the 12 wells some of these would doubtless yield water similar to 965 under like conditions of pumping, but the water of the twelve wells taken as a whole is quite like that from the infiltration well, indicating a common source, viz., sub-soil drainage. The infiltration sample differs from the twelve wells in a higher oxygen required and albuminoid ammonia and contains more bacteria, indicating a closer relation of the former to the surface. The lower incrusting constituents of the twelve wells would show that some of them contribute a softer water than is found in the neighborhood of the infiltration well where the scale forming element are excessive.

4. Sanitary value of the waters. The water from the air-lift well is a potable water of rather good quality. The waters of the infiltration and the twelve wells are similar, showing the effects of past pollution in their nitrates and chlorine; while their incrusting constituents are very high. Consequently they must be considered as undesirable although they might be usable. The high number of bacteria in the infiltration sample may be in part due to accidental contamination of the water by the collector as he had to climb down into the well to collect the sample. I am not inclined to place much weight on the suspicious organisms found in the twelve wells owing to their scarcity and to their departure from types. The water of Whetstone creek aside from being fairly soft was objectionable in all other regards, showing much pollution, having a bad odor and presumably a taste in keeping with the other determinations, although the test was not made. It could cause trouble in a supply if introduced in the raw state. Samples No. 965, 967 and 968 have revealed no objectionable taste or odor and evidently none existed in their sources at the time those samples were taken. Some iron was present in all the samples and a part of the free ammonia in the wells is certainly due to reduction of nitrates.

A copy of these reports with the following communication was sent to the Board of Health of Galion:

At your request we had an examination made of the condition of the water supply of your city. Both the report of the engineer and that of the chemist show that at the time this investigation was made no water was being taken direct from Whetstone creek. The engineer reports the existence of a 4-inch pipe leading from the pumping station to this creek, but this was not being used at the time of his investigation, and it is claimed has not been used for some time.

The chemical examination shows a considerable difference between the character of the water found in the infiltration well and that coming from the driven wells. This may have been due to the fact that the infiltration well had been filled with water from the well which was

being pumped by the air-lift; the action of the air-lift being to raise water from a much greater depth than could be done with the pumps. The examination indicates that at the time the investigation was made, the water supply was free from objections from a sanitary standpoint.

REPORT ON PROPOSED WATER SUPPLY FOR GLOUSTER.

The village of Gloucester made application to the Board for approval of a public water supply which it was proposed to obtain from two abandoned coal mines, the claim being that no other source of supply was available. This supply was condemned, a report of which was published in the last annual report of the Board. -

Another supply having been found, application for approval was made and the engineer went to Gloucester and submitted the following report:

This village was visited on February 16, 1900, the new supply investigated and samples of water collected for analysis. It is proposed to obtain water from the bottom land of a branch of Sunday creek. At the present time, however, February, 1900, mine water is pumped to the reservoir for fire protection.

This valley is located about one mile west of Gloucester and is formed by the coming together of two smaller valleys, in each of which is located a large coal mine. The workings of these mines approach within about 500 yards of the proposed site of the new supply. The bottom land is formed of the washings from the hills above and is composed of yellow and blue clay mixed with shale and some gravel. Into this formation a well 11 feet deep has been dug in which the water stands about three feet deep. The water seemed to trickle in from all sides at various depths and it would probably rise higher in the well after standing some time. A small wooden hand pump had been used on the well for a few hours preceding the inspection and the level lowered some, the exact amount unknown.

The water is of surface origin and limited in quantity as the amount of gravel is not large enough to give the ground a large capacity for water. There is no apparent pollution of the water; there is only one house in the neighborhood and it is 200 yards away. The surface of the valley and the hills near have been cleared of everything but a few scattered trees and the land is very much washed by the rapid runoff of the surface water, a fact which also tends to decrease the amount of ground water.

It is claimed that there is a bed of gravel below the clay and that the well should be dug deeper, but in this connection it must be noted that the mine workings draw off the very deep water, to some extent, at least.

Before approving this source of supply it would be advisable to test the amount of water available, as everything points to a limited supply.

The turbidity of the water is a factor which will have to be considered also, as it is very difficult to remove this clay and it seems probable that the water drawn from the strata in question will always contain more or less of it.

RESULTS OF CHEMICAL EXAMINATION OF WATER FROM GLOUSTER.

PARTS PER MILLION.

Number of sample.....	943
Color.....	.15
Turbidity.....	.89
Sediment.....	considerable
Odor.....	swampy
Oxygen required.....	3.84
N. as ammonia free.....	.652
N. as ammonia albuminoid.....	.182
Nitrogen as nitrates.....	.10
Nitrogen as nitrites.....	.001
Chlorine.....	23.4
Alkalinity.....	60.4
Incrusting constituents.....	61.8
Total solids.....	815.
Volatile and combustible.....	77.

"This sample is from a dug well one mile west of Gloucester and was taken February 16, by Mr. Flynn. The analysis yields the following features: While the physical properties may be better at other seasons of the year, they are at present very objectionable. On standing, the water presented a much improved appearance. The oxygen required and the nitrogen as albuminoid ammonia show considerable organic matter of a vegetative nature. The free ammonia might be lower, but it can hardly be said, under the circumstances, to indicate sewage influence. The chlorine is high for a surface water, but in view of its amount, the probable absence of other pollution as shown by Mr. Flynn's report, the presence of two mines in the valleys above the well, the high chlorine character of the mine waters of the vicinity (see No. 406 and 407, Gloucester waters examined in May, 1899, Annual Report 1899) it is in part if not entirely of mineral origin, and does not indicate sewage effect. The water is moderately soft. Like the sediment and the turbidity the amount of solids is greatly increased by the suspended clay.

The analysis indicates, that, under conditions eliminating the soil and vegetative matter present, the water would be a usable one; but in the present state the vegetative organic matter is undesirable, while the suspended soil makes the water an unsightly one for public supply."

The authorities of Gloucester were notified of the results of this examination and advised to make further tests to determine the quan-

tity of water available before going on with their work. They requested to be advised as to methods of testing the quantity of ground water liable to be available and the following letter of advice, prepared by the engineer, was sent to them:

In order to make a satisfactory test of the well inspected February 16th, it will be necessary to install pumping machinery at least equal to if not a little in excess of its maximum capacity. Also to put down test wells near the same to determine the effect of continuous pumping on the ground water level. These wells may consist of a small iron pipe driven into the ground to the same depth as the large well.

It would be advisable to start at first with three or four of these wells placed about 100 feet from the large well, in different directions, so that the sphere of influence of the latter can be determined. If the level of the water in the first row of wells is materially lowered, a second row must be put down and so on until the limit of area tributary to the large well is found. In this way the amount of water available per acre may be determined, also the economic distance apart the supply wells should be located.

On account of the unfavorable conditions for a large supply of water from the well in question, the best method of procedure would be to procure a small pump, of say 10,000 to 25,000 gallons capacity in twenty-four hours, and find out just how much the well can give; if the amount is very small and the well pumps down very quickly and fails to fill rapidly, it will be useless to waste further time on the present location, but better to seek some more favorable place at once; if on the other hand, the well gives a constant supply of water, even though small in amount, it would pay to determine the area it draws from and then roughly estimate the territory necessary to obtain the quantity desired. If enough land is easily in sight, more tests may then be made in various portions of this to determine more accurately the amount of water available from the whole area.

The maximum daily consumption of water for Glouster will approximate 300,000 gallons as soon as the works are well established and this amount must be had in view if not developed at once. This figure may be cut down by storage reservoirs to tide over unusual demands on the system and by carefully limiting the waste water at the outset.

PROPOSED WATER SUPPLY FOR THE OHIO HOSPITAL FOR EPILEPTICS AT GALLIPOLIS.

Dr. H. C. Rutter, manager of the Ohio Hospital for Epileptics at Gallipolis, asked that the Board approve of a water supply for use of said hospital; the supply to be obtained from two drilled wells, each 270 feet deep, located south of Mill creek road at some distance from the

institution. The water is found in sand and gravel at a depth of from 70 to 80 feet, the sand and gravel being covered with a layer of clay about 15 feet thick.

The chemist examined two samples collected March 7th, 1900, and reported upon them as follows:

RESULTS OF EXAMINATION OF WATER FROM HOSPITAL FOR EPILEPTICS AT
GALLIPOLIS.

PARTS PER MILLION.

	Drilled well No. 1.	Drilled well No. 2.
Number of sample	975	976
Color	none	none
Turbidity	none	none
Sediment	none	none
Odor	none	none
Oxygen required . . . . .	.61	.79
N. as ammonia free . . . . .	.030	.048
N. as ammonia albuminoid . . . . .	.018	.024
Nitrogen as nitrates	5.94	7.02
Nitrogen as nitrites	none	none
Chlorine	133.2	278.0
Alkalinity	194.2	199.8
Incrusting constituents	71.4	148.6
Total solids	558.	927.
Volatile and combustible	162.	277.
Iron	trace	trace

The physical properties of the water were practically perfect, and the low findings for oxygen required, nitrogen in the form of free and albuminoid ammonia, and the absence of nitrites show the freedom of the water from any recent pollution from organic sources. The chlorine shows the presence of considerable salt water, which was entirely cased off, and it is quite possible that a portion of the hardness and nitrates gained access in the same manner. In support of this it should be noted that the water from well No. 2 contained about twice as much chlorine as No. 1, also contained twice as much incrusting material and a greater proportion of nitrates.

While neither one of the samples is soft, I should anticipate no especial criticism by the consumers from well No. 1 on the hardness, but the water in No. 2, as shown by the sample, is somewhat harder (see incrusting constituents No. 976), and doubtless would provoke some complaint though perhaps to no serious extent, owing to the action of sodium chloride.

The nitrates are rather high, but if they be considered in this case as standing for past pollution, it must be remembered that the other determinations show the purification to have been complete and thus no danger exists in using the water.

The examination reveals no reason why these waters would not be acceptable ones for domestic purposes aside from some possible objection arising from their mineral characters.

The proposed water supply for the Ohio Hospital for Epileptics at Gallipolis was approved by the State Board of Health.

REPORT UPON AN ADDITIONAL WATER SUPPLY FOR LEETONIA.

The village of Leetonia having made application for an additional public water supply, the engineer was directed to visit Leetonia and make an investigation. He made this visit on October 26th, and reported as follows:

Leetonia has an estimated population of 3,500, and its principal industries consist of two large blast furnaces. The village site occupies the flat sandy bottom-land of Cherry Fork of Beaver creek and the high land adjoining.

Private wells obtain their water in the sand near the surface and were soon so badly polluted that a public water supply was installed in 1889 in an attempt to better conditions. The water was obtained from a series of springs which were flowing from the slope of a gravel bluff situated just southeast of the village. This spring water is now collected by 17 brick wells, each 3 feet in diameter and 7 feet deep, and flows by gravity from these to a pump well 1,500 feet to the west, towards the village. From this large well it is pumped to a distributing reservoir for the supply of the town.

These springs soon failed to supply enough water, and in 1894 a filter was installed and more or less filtered creek water has been used ever since. The filter consists of two beds, each 24 by 58 feet, and filled with 4 feet of sand. These have been occasionally cleaned by scraping off the sand until it now has a thickness of about 30 inches. No care seems to have been taken of this filter and it is now considered to be in an unsatisfactory condition. Nothing is known as to the amount of creek water used or of the rate at which it was filtered. The "Cherry Fork" water is brought to the filters from the forebay of a mill just above the village and above local pollution, but the water is of poor quality as the race is full of refuse and receives the drainage from neighboring barns and hog-pens.

The "Springs" supplied a little over 100,000 gallons of water per day in September, no creek water being used, and it is estimated that 160,000 gallons will be sufficient for the village.

The hill portions of Leetonia are without water nearly every night. There are 348 services in use and many more would be made if the

water could be guaranteed. With a reasonable increase an average supply of 200,000 gallons daily would be sufficient for a few years to come and 160,000 gallons seems to be an ample estimate for the present.

It has been proposed to add to the supply by the following means:

1st. Certain springs of same character as present supply and situated some distance east of same. Objected to, as it is claimed that the flow is not large enough to warrant piping to the present pump well.

2nd. Filtered water from small branch of Cherry Fork. This source is proposed by the village council but no detailed plans have been prepared as to the method of collecting and filtering the water. The run is very small and could not furnish a supply without an impounding reservoir to store water for dry season. At time of inspection there was not sufficient water in the run to enable a sample to be collected without constructing a dam or digging a hole to catch the water in. As plans for this scheme have not been developed, no report can be made until further information is furnished.

3rd. Three wells in valley of above mentioned run and 5,000 feet south of the present pumping station. These are 6 inches in diameter, 58, 54 and 52 feet deep respectively; and all go through 8 feet of soil, 22 feet of fire clay and slate, and the balance through sandstone down to slate. The water seems to be of good quality as far as appearance goes and also from analysis of a local chemist. A copy of same was given to Mr. Horton. Samples, chemical and bacteriological, were taken from the 58-foot well and sent in for analysis.

It is proposed to pump or siphon this water to the pump well and the trustees only await the approval of the Board and the bond issue by the council, \$6,000 having been voted for by the people. The council had a committee test one of the wells and claim sufficient water was not found and so far refuse to issue bonds, wishing, it is claimed, to use the creek water. The committee put in a deep well pump in well No. 2, with a cylinder 44 feet down from the surface and pumped same for 36 hours at a rate of 51,800 gallons per 24 hours. This was found to be the capacity of the one well at 44 feet. The other wells, distant 50 and 80 feet from the tested well, were lowered 13 and 8 feet respectively, the water flowing out of all when they are not being pumped.

Owing to the good quality of this water it would seem advisable to further test the wells before abandoning them, especially as the one well furnished nearly the amount of water required.

If it is deemed advisable to approve these wells, it is respectfully recommended that the present casings be drawn and tight ones put in down to the rock, so that there will be no possibility of contamination from surface water.

RESULTS OF CHEMICAL EXAMINATION OF WATER FROM LEETONIA.

PARTS PER MILLION.

Number of sample.....	1450
Color.....	.13
Turbidity.....	trace
Sediment.....	trace
Odor.....	none
Oxygen required.....	.79
N. as ammonia free.....	.262
N. as ammonia albuminoid.....	.067
Nitrogen as nitrates.....	none
Nitrogen as nitrites.....	none
Chlorine.....	1.8
Alkalinity.....	312.4
Incrusting constituents.....	none
Total solids.....	429.
Volatile and combustible.....	126.
Bacteria per c. c.....	140
	Colon not present.

Sample taken from well No. 1.

In commenting upon these figures the chemist says: "The findings of the analysis show that no appreciable amount of surface water is gaining admission to this well. The water is not objectionable from the standpoint of quality, since the analysis indicates a sub-surface water of good quality, and one that will in all probability prove satisfactory if used for a public supply."

The Secretary recommended that the proposed additional supply be approved, with the recommendation that the village authorities make further pumping tests to determine the quantity of water obtainable before the adoption of these wells as a permanent source of supply.

The Board voted to approve the supply upon the above conditions, and notice was sent to the Mayor and Council November 13th, 1900.

REPORT ON THE PROPOSED WATER SUPPLY FOR LEIPSIC.

An application was received, requesting the Board's approval of plans for a new water supply for the village of Leipsic. The Engineer, Mr. Flynn, visited Leipsic on July 10th, investigated the proposed supply in company with Mr. A. Stechschulte, water works trustee, and Mr. G. L. McKibben, engineer in charge, and reported as follows:

Leipsic has an estimated population of 2200, and West Leipsic, adjoining, contains some 500 people. It is expected that West Leipsic will join with Leipsic in the use of the water, so that the total population to be supplied is about 2700.

In the spring of 1899 bonds were issued for \$25,000, with which the entire plant must be completed. So far in the search for water, seven wells have been put down, two of which are of no value, and the remaining five, located in the western part of the village, are expected to furnish the supply. A piece of ground, 380 feet by 132 feet, has been secured just west of the D., L. & N. R. R., in which five wells were drilled during the spring of 1900. These wells are in two rows, 100 feet apart, and the individual wells are from 100 to 150 feet apart. Four of the wells are six inches in diameter, one is eight inches in diameter and all are from 131 to 135 feet deep. The wells go from 80 to 82 feet through the drift formation, then strike the limestone and go 51 to 53 feet into same. The normal level of the water is 34 feet from the surface. The only local pollution consists of the vault used by the D., L. & N. R. R. depot, and it is claimed that this will be removed. There are very few dwellings in the vicinity of the wells, but they are located between Leipsic and West Leipsic, and the site may become more densely populated in the future.

At the time of the inspection, no information could be obtained concerning the quality or quantity of the water on account of the breaking down of the test pump. From information just received from Mr. G. L. McKibben, it appears that there is a sufficient quantity of water. A sample of the water, collected August 13th, was sent in at the same time and examined by the Chemist of the Board, who reported as follows:

RESULTS OF CHEMICAL EXAMINATION OF WATER FROM LEIPSIC.

PARTS PER MILLION.

	Well No. 7.
Number of sample.	1285
Color.	none
Turbidity.	none
Sediment.	trace
Odor.	oil
Oxygen required.	0.96
N. as ammonia free. ....	.242
N. as ammonia albuminoid. ....	.054
Nitrogen as nitrates.	none
Nitrogen as nitrites.	none
Chlorine.	28.3
Alkalinity.	142.8
Incrusting constituents.	27.8
Total solids.	616
Volatile and combustible.	131.

"The analysis shows that as regards organic matter, this sample was comparatively pure; the free ammonia came from reduction of the nitrates and is not objectionable. The mineral characters are not high for a rock water. While the solid formations pierced by this well are

not given in the information blank, it would seem that this water is derived from the Onondaga limestone, which is one of the best formations we have for potable waters. The odor is the one objectionable feature in the analysis, and of course the sample does not show whether the odor was imparted to the water by the machinery of the well or by some previous agency; if from the machinery, it is of but little moment, but if this odor should be permanent, it would give rise to complaints from consumers."

Considering everything, the proposed supply appears to be satisfactory, the only objection being the unfavorable location in regard to future growth. This feature should be called to the attention of the local authorities, as it may cause trouble at some time in the future, but not at present. I would respectfully recommend that the supply be approved, with the condition that the present purity be maintained.

The Board voted to approve the supply upon the condition recommended in the above report, and notice of such action was sent, with a copy of the report, to the engineer for the village, August 31, 1900.

REPORT ON ADDITIONAL WATER SUPPLY FOR LYNCHBURG.

An application was received from the village clerk of Lynchburg, requesting the Board to approve plans for extending their public water supply. The engineer visited Lynchburg October 9th and presented the following report:

Lynchburg has an estimated population of 1,000. Its principal and almost only industry is a large distillery.

The public water supply was at first obtained from a dug well, 16 feet in diameter and 20 feet deep, which enters a bed of gravel just above the rock. This well soon failed to furnish a sufficient supply of water and a four-inch suction was sent to a large pit or canal from which the distillery obtains its water supply. This canal consists of a trench 120 feet long, 15 feet wide, and excavated 15 feet in sand and gravel. At each end of the trench there is a well 18 feet in diameter and 15 feet deep. The sides of the canal and wells are planked up and the whole is planked over at the ground level. The pit occupies a low swale and is easily accessible to surface drainage, some of which is objectionable. In July, 1900, the four-inch suction was replaced by a five-inch line. Neither the original well or the canal can furnish a first-class water on account of the surface pollution.

The distillery expects to open up for the season on the first of November, and they will then use all the water available from the canal and the village can no longer obtain any water from this source.

The sources proposed for an increase in the public supply consist of three springs, only one of which, known as the Sulphur Spring, is worth considering at all. Smith's spring is a small, wet weather spring, in the back yard of a farm house, and is not suitable either in quantity or quality.

The Lynn spring is a very small one, in a low, marshy place, near the East Fork of the Little Miami river. As a spring, it is not suitable, but the location might be developed by means of wells.

The Sulphur spring is located one and one-quarter miles northeast of the village, in low land, near a small run. It is in a pasture lot with a barn 50 yards away, but with a little care, all surface pollution can be diverted. While it is known as the Sulphur spring, it has but a faint taste and smell of sulphur, and, as far as appearance goes, could furnish an acceptable water, unless the water should acquire a bad taste and odor from standing in the pipes. On the day of inspection it was flowing at the rate of about 13 gallons per minute, or 18,650 gallons per 24 hours, at a height of about two feet above the ground. It is claimed that this flow is maintained the year round.

No data could be secured regarding the present consumption, but it would not appear that the above amount would be long sufficient for a village of this size. With suitable development, the natural flow could no doubt be increased. It is proposed to build a storage cistern at the pumping station and to conduct the spring water to the same by gravity.

RESULTS OF CHEMICAL EXAMINATION OF WATER FROM LYNCHBURG.

PARTS PER MILLION.

	Sulphur Spring.
Number of sample.....	1433
Color .....	.10
Turbidity	about .04
Sediment	trace
Odor	trace
Oxygen required .....	.89
N. as free ammonia.....	.014
N. as albuminoid ammonia.....	.040
N. as nitrates.....	trace
N. as nitrites.....	none
Chlorine	1.3
Alkalinity	284.0
Incrusting constituents	none
Total solids	373.
Volatile and combustible.....	107.

"The water lacks little of being clear, but otherwise it is a good water. It is comparatively free from organic matter and nothing appears to show that it would not be a potable water of good quality."

The Board voted to disapprove Lynn spring as a source of additional supply, and gave its approval of Sulphur spring, with the provision that by ditching, or other necessary means, the spring be protected against surface pollution, and notice of such action was sent to the village clerk, November 1, 1900.

REPORT ON A NEW WATER SUPPLY FOR McCONNELLSVILLE.

The Secretary submitted the following report to the Board, of an inspection of a new water supply proposed for the village of McConnellsville.:

The village of McConnellsville, through its consulting engineer, Mr. Charles F. Sturtevant, has submitted plans for the approval of a public water supply, to be obtained from wells. The plan which I send you shows at the bottom left hand corner of the map the exact locotion of the four wells, to-wit: near the juncture of Beech and Jefferson streets, and a section of formations which the wells pass through. The populated territory east of the river and west of the west line of Elm street is very small, and this territory is not suitable for building purposes. A sample of water from one of the wells was examined and reported upon by the chemist, as follows:

RESULTS OF CHEMICAL EXAMINATION OF WATER FROM McCONNELLSVILLE.

PARTS PER MILLION.

	Test well No. 1.
Number of sample.....	490
Color ..	trace
Turbidity ..	none
Sediment ..	trace
Odor ..	none
Oxygen required ..	1.56
N. as free ammonia.....	.003
N. as albuminoid ammonia.....	.021
N. as nitrates.....	.36
N. as nitrites.....	.003
Chlorine ..	13.5
Alkalinity ..	289.3
Incrusting constituents.....	131.5
Total solids.....	727.
Volatile and combustible.....	.148

"The nitrites and nitrates of this water show a small amount of past pollution, however, the low nitrogen as free and albuminoid ammonias show no recent pollution; and, furthermore, show good purification of the small past pollution. The mineral character of the water shows that but little, if any, of it comes from the river."

The water may be classed as a deep water, and I would recommend that the supply be approved.

The Board voted to approve the proposed supply, and notice to that effect was sent to the Mayor and Council of McConnellsville, November 20th, 1900

REPORT ON THE PROPOSED ADDITION TO THE WATER SUPPLY OF PAINESVILLE.

The health officer of Painesville called the attention of the Board to the fact that they were having an unusually large number of typhoid fever cases in that place and asked that the matter be investigated. At the same time he stated that the Water Works Trustees of Painesville contemplated extending their water works system. After some correspondence a communication was received from the Water Works Trustees asking the Board to approve certain plans for extending their water supply. Dr. W. T. Miller was appointed a committee to visit Painesville and report. On August 2nd, 1900, he visited that place, accompanied by the engineer, Mr. Flynn, and they presented the following report:

Painesville is now supplied with water gathered from the sandy beach of Lake Erie by peculiarly constructed galleries which consist of wooden frames, 14 inches high, 20 inches wide, and 8 feet long, laid end to end in a trench excavated from 6 to 7 feet in the beach. The boxes are covered with a wire screen and surrounded with a foot of screened lake gravel, then covered with lake sand. It is intended to keep the line of boxes just under the edge of the water so that the wave action will keep the sand clean and allow the water to flow freely to the galleries. The beach at the water works has been building for a number of years so that the galleries have gradually come from under the influence of the wave action of the beach and the sand layer overlying them has become clogged and the capacity of the galleries greatly reduced. In winter, owing to the formation and collection of ice on the beach, the sand becomes further clogged and the supply reduced. Last winter from January to April the supply was so short that the lake water had to be used direct for a greater part of the time. This water was collected by a short intake pipe and was highly objectionable as a supply.

To overcome this deficiency it is proposed to add 1000 feet more, to the present 1,000 feet of gallery in use, by another line outside the present one. This new gallery will be constructed in the same manner as the old and it is expected to supply 2,000,000 gallons per day; the old galleries failed to supply 1,200,000 gallons in the winter. The new gallery will no doubt supply a large amount of water until the change in the beach, or an accumulation of ice shall bring it out from under the influence of the wave action, when the supply will fall short as before and make it necessary to use the lake water direct.

The present daily consumption is about 1,700,000 gallons, all of which it is claimed is supplied by the gallery.

It is necessary that the lake water collected at or near the present pumping station be carefully filtered before it is used for domestic purposes on account of the danger of pollution from the sewage of Grand river. It is stated that a continued strong wind from the northeast will send the river water around onto the beach at the water works station. The water supply has been far from satisfactory as shown from the large number of cases of enteric fever and by twelve deaths, in a population of 8,000, from the same disease since December 2nd, 1899.

In view of the above facts your committee would respectfully recommend that the present system of collecting water at Painesville be considered unsatisfactory, especially during the winter season; that the proposed addition is merely an extension of the old system, and while it may supply a usable water for a time it is not a satisfactory means of increasing the supply. Not only from a sanitary standpoint is the addition unsatisfactory, but also from the financial side; as the present scheme will afford temporary relief only and new works will be required from time to time in the future as in the past.

Your committee further recommends that the water works trustees of Painesville be advised to secure a competent engineer to look over the ground and prepare plans for a more efficient and reliable system of filtration, and that such plans be submitted in detail to the State Board of Health for approval, as required by law; also that a marked copy of the law in question be sent to the above named trustees.

The report and plans were submitted to the Board and it was voted to disapprove the plans for increasing the water supply of Painesville. A letter was sent to the Water Works Trustees advising that the services of a competent engineer be secured to prepare plans for some more efficient and reliable system of filtration.

REPORT UPON A PROPOSED WATER SUPPLY FOR PIQUA.

The city of Piqua made application for the approval of a new water supply. The Secretary visited Piqua October 6th and with the Water Works Trustees examined some of the wells and went over the ground from which it was proposed to obtain a supply. Samples of water from two or three of the wells were taken for examination. Later some additional wells were put down and the chemist went to Piqua and collected additional samples of water for examination. Many of the wells not proving satisfactory as regards quantity, still other wells were put down by the Water Works Trustees. The engineer went to Piqua on December 2nd, and submitted the following report:

Piqua has a population of some 13,000. It is at present supplied with water from the "Hydraulic," a feeder of the Miami and Erie canal. This water is extensively used for manufacturing purposes and for sprinkling, but not at all for domestic purposes. The present average daily consumption is 1,500,000 gallons with a large maximum in the summer. There are 1,250 services in use, with none metered. Owing to the unsatisfactory condition of the water the trustees have at several times prospected for water with but poor success until the present experiments. In 1896 eight wells were sunk in various parts of the city, most of which entered limestone or clay and gave but little water. Other wells have been sunk by manufacturing companies with like success. The present wells have been sunk in a gravel bed north of the city and between the Great Miami river and Rush creek. This gravel bed is from one-fourth to one mile wide and about two miles long. It is thought, and with some reason, that it is an old bed of the Miami river. The whole area occupied by the bed is overlaid by an exceedingly varied covering of drift, consisting of clay, hardpan, sand and gravel, laid down in very irregular pockets and strata. This can be seen from the lack of uniformity in the strata passed through by the wells. Of the eighteen wells put down ten have passed through some impervious covering, hard-pan or clay, and the other eight through porous material all the way down. The impervious layers passed through by some of the wells can be but little protection from surface pollution as the strata are not continuous; seepage water can enter the water bearing gravel through the porous strata which are mixed in with the clay and hardpan.

The following table shows the depth of the various wells, the strata through which they pass, and the capacity when tested:

PIQUA WELLS; STRATA, DEPTH, AND CAPACITY.

Well numbers.	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
Soil and gravel.....	1.5	5.6	5	8	10	7	...	25	17	30	7	8	10	8	10	10	8	9
Sand and gravel.....	...	...	...	6	...	10	...	...	1	...	...	17	20	17	18	24	...	...
Clay and blue clay.....	4	10	8	3	...	...	...	...	...	2	...	6	...	6	...	...	...	...
Water gravel.....	15	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
Soft gray clay.....	...	...	4	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
Hard-pan.....	7.6	.6	7	2	...	...	...	...	...	2	...	...	...	...	6	...	...	...
Sand and clay.....	...	...	...	...	6	28	18	...	11	...	...	...	...	...	...	...	...	...
Water gravel.....	...	1	...	...	3	...	...	...	...	...	...	...	...	...	...	...	...	...
Water sand.....	3.6	...	...	7	10	...	...	...	10	...	...	...	...	...	10	10	...	...
Blue clay.....	...	12	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
Hard-pan.....	7	...	...	...	...	...	11	...	...	...	...	...	...	...	...	...	...	...
Quicksand and clay.....	...	10	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
Beeswax clay.....	75.8	...	...	...	...	...	...	4	...	...	...	...	...	...	...	...	...	...
Light blue clay.....	...	9	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
Sandy clay.....	...	...	...	8	...	...	...	...	...	...	...	...	...	...	...	...	...	...
Shale.....	...	25.6	14	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
Water sand, gravel.....	...	...	14	...	5.4	...	1	...	16	15	33	7.5	13	7	10	6	38	40
Fine sand.....	...	...	...	10	...	4	...	...	10	...	...	...	...	...	...	...	...	...
Hard-pan.....	...	...	...	...	...	...	24	...	...	...	...	...	...	...	...	...	...	...
Total depth.....	124	73	38	44	34	49	54	29	65	49	40	38	43	38	54	50	46	49
Capacity in gals. per min.	125	...	...	200	250	...	...	...	560	340	275	280	200	...	260	...	...	...
Level of water below sur..	1	2	0	3	1	20	...	1	6	7	8	8	9	8	9	9	8	9

Rush creek has a watershed of $22\frac{1}{2}$ square miles in area, most of which seems to consist of rolling farm land, sparsely timbered with a heavy clay soil. This gives a rapid runoff, leaving but little to keep up the summer flow. Rush creek is dry a portion of the year as the bottom land along the creek is underlaid with gravel beds into which the low flows of the stream disappear. The gravel bed tapped by the wells is fed indirectly by this subsurface flow and directly by seepage water from the surface. It may be fed also to some extent by the subsurface flow of the Miami river, especially if the theory that the bed is a former channel of the river is correct. The wells have not been pumped very extensively, but the few tests made show plenty of water with but little falling in level while pumping and seemingly no effect upon the level of neighboring wells. The latter result is no doubt due to the great irregularity of the strata. The bed of gravel is very loose, so loose that most of the wells could be driven, a drill not being required. This gives a large storage capacity for water.

Considering everything, the supply is probably adequate for Piqua for many years to come, especially if meters are installed on all services as it is claimed will be done.

Owing to the character of the covering of the gravel bed, the pollution of the water is almost identical with that of the surface. The watershed has a population of about 1,000, all of which can be considered rural. About 250 of the total population is gathered in the village of Rossville, which village is the only serious source of pollution. This place has no sewers whatever, every house being provided with the ordinary out-door vault. In this manner a certain amount of filth enters the soil, polluting the ground water. This has not been felt as yet in the wells, as shown by the analyses and will probably not be felt seriously until the wells have been pumped for some time causing the ground flow to set in towards them. Then this sewage will show, but if the amount is not increased it will not endanger the supply. To prevent its increase it will be necessary to carefully sewer the whole village, and for further protection it would be wise to lay out for park purposes all the land in the immediate vicinity of the wells. In addition to the pollution to be derived from Rush creek watershed, wells Nos. 1, 4, and 5 in the bed of the river may be polluted to some extent by the subsurface flow from Piqua. Analyses of the water from time to time would be necessary to show the extent of this.

Owing to unfavorable location, or to failure to find sufficient water, wells Nos. 2, 3, 6, 7, and 8 have been abandoned and the casings drawn.

The amount of water, from all indications, is sufficient. The quality of the water at present ought to be good, but continued pumping and increased surface pollution may seriously affect its purity. Some steps should be taken to protect the supply if it is to be used. These should

probably consist of a sewer system for Rossville and the removal of all dwellings and barns from the immediate vicinity of the wells.

RESULT OF CHEMICAL EXAMINATION OF WATER FROM PIQUA.

PARTS PER MILLION.

	Well No. 4.	Well No. 5.	Well No. 9	Well No. 11.	Well No. 11.	Well No. 15.
Number of sample.....	755	756	819	820	840	841
Color.....	trace	trace	trace	.1	trace	.1
Turbidity.....	distinct	distinct	trace	decided	less than .06	.45
Sediment.....	slight	slight	trace sandy	con. sandy	sandy, very slight	slight
Odor.....	none	none	none	none	faint, earthy	earthy
Oxygen required.....	1.29	1.23	.75	1.03	.86	2.15
N. as ammonia free.....	.009	.003	.011	.012	.012	.012
N. as amm. albuminoid..	.020	.018	.012	.062	.018	.026
N. as nitrates.....	2.54	2.77	2.65	2.85	3.08	2.57
N. as nitrites.....	.005	.008	.002	trace	.003	.002
Chlorine.....	1.1	1.0	.6	.9	1.1	1.3
Alkalinity.....	242.2	236.2	236.4	238.8	238.6	244.8
Incrusting constituents.	4.6	21.2	none	none	none	trace
Total solids.....	408.	423.	326.	1795.*	360.	447.
Volatile and combustible	130.	122.	90.	304.	118.	119.
Iron.....					.5	3.2

* 144 in suspension.

Samples 755, 756, collected October 6th, 1899.

Samples 819, 820, collected November 9th, 1899.

Samples 840 and 841, collected November 16th, 1899.

Sample 840, also from well No. 11, was taken because the former sample (820) was not considered a fair sample owing to the short period of pumping for a new well.

"As far as the analyses are concerned the water from wells 4, 5, and 9 can be considered as one, as the results run very closely all the way through. They are unusually soft waters. The nitrogen as free and albuminoid ammonia is quite satisfactory. The chlorines are very low. The most noticeable feature of these waters is the presence of nitrogen in small quantities as nitrites, but more especially as nitrates. In other words, at some time, some organic matter has been present either in the water or in the soil washed by this water. However, it has been oxidized until it now appears in the stage most desirable, viz., the mineral form as nitrates. Had this organic matter been of sewage origin or due to the presence of a considerable number of animals upon the soil as in a dairying section, there would have been greater amounts of chlorine, but as the chlorine is very low we can only conclude that the nitrates come from vegetable matter and accordingly the presence of nitrates under these conditions cannot be considered a menace to health. The results of the analyses indicate that the waters from wells 4, 5, and 9 would make a safe and acceptable public supply.

A comparison of 840 and 820 shows the improvement due to pumping, viz., a great falling off in total solids, turbidity and sediment, due

to sand and clay. As expected, the clearer water, 840, shows a decrease in oxygen requirement and albuminoid ammonia. The present sample from well No. 11 is low in its oxygen requirement and ammonias and so low in chlorine as to preclude any sewage pollution other than what little might come from farming sections. The water is soft. Were it not for the nitrogen as nitrates and nitrites this would be an unusually good natural water. As it is the analysis indicates that the vegetative organic matter of the past has been oxidized to mineral form and has therefore reached the most desirable stage. The absence of nitrates is desirable, but coming from vegetative sources they cannot be considered objectionable in the way that nitrates of sewage origin are. The analysis would indicate a water whose use would be safe and satisfactory.

Everything indicates that well No. 15 would yield, on pumping, a water almost, if not quite, identical with well No. 11, and this water would doubtless prove a satisfactory one for a supply. In making this approval of the water from well No. 15, the iron is considered in sample No. 841 to be due to iron rust from the pipes, etc., and it would disappear when the pipes had been used longer for water conductors."

The Secretary reported that the results of the investigation seemed to indicate that these wells would afford a reasonably pure public water supply, and recommended that the supply be approved with the provision that proper measures be taken to guarantee these wells against local contamination.

The Board voted to approve the proposed supply, and notice of such approval was sent to the Secretary of the Water Works Department at Piqua, December 18, 1899.

The health officer of Piqua, Dr. F. E. Kitzmiller, appeared before the Board at a meeting held in Columbus, January 24th, 1900, and stated that for reasons, which were explained at some length, it would not be possible for the city to carry out their original plan in regard to the location of the wells for the public water supply. He presented a request from the Water Works Trustees of Piqua for the approval of a supply to be obtained from wells located upon an island in the Miami river situated between Piqua and Rossville, with a map showing the exact location of the wells.

The matter was considered by the Board and it was voted to approve of this proposed supply. Notice of approval was sent to the Water Works Trustees February 23, 1900.

REPORT ON A WATER SUPPLY FOR SEBRING.

The Sebring Land Company made application for the approval of a public water supply for the village of Sebring. Mr. Josiah Hartzell, as a committee, made an investigation and reported as follows:

Sebring is a village of five or six hundred. In April last there was not a house on the present town site. A large pottery works accounts for the village, which is growing very rapidly. I visited the village December 2nd, obtained a sample of the water and sent it to our Laboratory for examination. The chemist reported upon this water as follows:

RESULTS OF CHEMICAL EXAMINATION OF WATER FROM SEBRING.

PARTS PER MILLION.

	Deep well, proposed supply.
Number of sample.....	865
Color	trace
Turbidity .....	.16
Sediment	slight
Odor	peculiar
Oxygen required	1.04
N. as ammonia free.....	.742
N. as ammonia albuminoid.....	.033
Nitrogen as nitrates.....	trace
Nitrogen as nitrites.....	.001
Chlorine	33.2
Alkalinity	365.2
Incrusting constituents.....	none
Total solids.....	591
Volatile and combustible.....	112
Iron	0.5

"The analysis shows water of good standing as regards organic purity. The free ammonia comes from reduction of the nitrates in the presence of iron and is unobjectionable. The chlorine is doubtless of mineral origin and in the form of potassium or sodium chloride as indicated by the absence of scale forming elements. While the sample contains some mineral matter, the total solids show that the water is not rich in minerals. Iron is not absent. The physical properties are not quite as good as they might be although not bad. Some objection might be raised to the odor. On the whole the results of the examination would indicate an acceptable water for a public supply, barring possibly some objection to the odor and appearance."

The region is a flat, clay country and has previous to the inception of the village is sparsely occupied. The well is near the pottery, on the south side of the Fort Wayne railroad—the village is on the north side, and its area does not include the well.

It is an artesian well, 5 5-8 inch bore and goes, first, through 80 feet of fire clay; then 2 feet of flinty shale; then 102 feet of blue soapstone, to rock; then 20 feet into the rock, the upper stratum of which is fine, dry sandstone, then a coarser sand in which the water is found, apparently in large quantities. In boring, surface water was found

at 19 feet, otherwise it is a dry hole to the supply used, and the whole is iron-cased to the rock.

I recommend approval.

The Board voted to approve the supply and notice was sent to the Sebring Land Company, January 6th, 1900, that the State Board of Health approved of the public water supply for the village of Sebring, to be obtained from a deep artesian well.

REPORT OF AN ADDITION TO THE WATER SUPPLY OF SPRINGFIELD.

Notice having been received from the Secretary of the Board of Water Works Trustees of the city of Springfield, that an increased supply of water for that city was contemplated, Dr. Warner as a committee, accompanied by the Engineer, visited Springfield on July 14th, 1900, and the following report was submitted:

Springfield is at present supplied with water from a large well and gallery located in the fork of Beaver and Buck creeks above the city. The gallery is 200 feet long, $2\frac{1}{2}$ feet wide, 4 feet high and leads to a covered brick well 30 feet in diameter and 21 feet deep. The gallery is constructed of loose stone and is covered with an iron cap, so the water can reach it from both sides as well as from the bottom. The well and gallery are both in a large bed of gravel 23 feet thick, which is underlaid by a bed of hardpan, and until last year enough water was drawn from this gravel to supply the city.

Last year was an exceptionally dry one and the supply ran so short that it had to be helped out with water from the old station below. At this station there is an old gallery and two wells, the former source of Springfield's water supply. The water from this source was pumped by an old engine left at the station, to a reservoir near the new station and allowed to flow from there to the pump well. Even this increase in the supply was not sufficient for all purposes and Springfield was left in very bad shape in case of fire.

To overcome this danger the trustees have this year tapped the old 20 inch main, leading from the old station to the reservoir, at Buck creek and put in a 12 inch pipe so that the water from the creek can flow direct to the reservoir. They intend to keep the reservoir full and to allow the water to seep through into the well and gallery and only to use the water direct in case of a large fire. The reservoir to which the water is admitted from Buck creek is 250 feet by 500 feet by 15 feet deep and is excavated in the gravel so that at all times it contains a certain amount of water which has seeped in from the ground. The trustees propose to keep this reservoir full and to allow the water to filter through to the pump well 360 feet away. This seepage

will no doubt take place for some time but the sides of the reservoir will puddle sooner or later, depending upon the turbidity of the water admitted to it. As long as the creek water must reach the gallery by seepage only its addition to the supply would not be objectionable but as there is a direct connection, a 30 inch pipe, between the reservoir and the pump well there will always be the temptation to admit the water direct in case the well should get low.

The reason given for the hurried action of the trustees was that the ownership of the water right on Buck creek was in question and they wished to avoid an injunction. They wish an approval of the new supply so that condemnation proceedings can be taken to secure the absolute control of the water.

The water supply of Springfield could be properly increased by filtering the water of Buck creek or by the extension of the present system of galleries, especially in the gravel beds which are said to be above the pumping station, but it must be noted, however, that the present scheme of allowing the water from the reservoir to fill the gallery by seepage will be successful for a certain length of time, depending, as stated, upon the turbidity of the water of Buck creek.

Last year the average daily consumption was about 3,000,000 gallons and it is claimed that it is nearly one million less this year so that the need of an additional supply should not be so pressing for use in case of fire.

REPORT ON PROPOSED WATER SUPPLY FOR VERSAILLES.

A request was received from the Water Works Trustees of the village of Versailles, Darke County, to approve a new water supply for that village, to be obtained from wells located within village limits. The engineer, Mr. Flynn, was sent to Versailles and he reported as follows:

This village was visited on May 1st and the proposed supply investigated in company with John Nichols and J. C. Klineschmidt, water works trustees; the third member, L. C. Klipstine, being out of town.

Versailles has an estimated population of 1,500. It is supported largely by the neighboring farmers but also has the following industries: a tile mill, two poultry shipping houses, saw mill, creamery, and several tobacco packing houses.

The drainage of the village is to Swamp creek through surface ditches and one short storm sewer. Privies are required to have water-tight vaults or boxes, but as usual these regulations are not enforced very strictly. Many privies were noticed which were provided with neither vault nor box of any kind. The private water supply is from driven and dug wells varying from 12 to 40 feet in depth. Those in the eastern part of the village are in clay with but little gravel, while those

in the western part are entirely in gravel. It may be well to note here that it is generally acknowledged that there is more typhoid fever in the western part where the gravel wells are in use than in the eastern part where the clay wells are.

The Big Four Railroad, which goes through the center of the village, opened up at the time of its construction some 40 years ago, a borrow pit in the western part of the village and removed an enormous amount of gravel. Most of this excavation has not been disturbed since that time, but the part nearer the center of the village has received much rubbish, principally ashes, straw, sawdust, tin cans, and some manure and garbage.

In this pit at a point nearest the inhabited part of the village it is proposed to dig a well for a public water supply. A test well 265 feet deep was first drilled but it was claimed that but little water was found, except near the surface, and deep wells were then abandoned. Now a 13 foot well has been driven into the gravel and plenty of water found about 10 feet down. The surface of the gravel at this point is about 20 feet below the original surface of the ground. The surroundings of this well are not of the best. Within about 200 feet of the proposed well there are six privies, one hog pen, six barns, four houses, and several heaps of rubbish. It is claimed that much of this will be cleaned up, however. At a little greater distance there are many more of the above, also two stagnant ponds which receive the refuse from a poultry dressing house, and it is said that they become very offensive at times, though they were not so at the time of this investigation.

It was stated that the valley of Swamp creek lying to the west and southwest of Versailles, contained much gravel and supposedly plenty of water, and that the present site was selected on account of the cheapness of the lot, which has already been purchased, and by the fact that a railroad switch could easily be put in. This latter reason was given more weight here as it is intended to put an electric light plant in the same building.

From the surroundings of the well to be used for the supply it is difficult to see how it can furnish a potable water for any length of time, especially as the chemical analysis of the water now shows some evidence of past pollution. As soon as the plant was installed here and a large amount of water pumped, the ground water flow would set in toward the well from all sides, bringing in objectionable drainage from a larger area and much more quickly than at present thus giving less opportunity for purification.

Chemical and bacteriological samples were taken from the 13 foot driven well and from a 13 foot dug well located 19 yards from the former. The driven well was put down for this test and had been pumped but little if any until two hours before the sample was taken. Instructions had been sent to have this well pumped but unfortunately they were not carried out. Before the sample was taken, however, a small hand pump

was attached to the well and the same pumped for two hours, which was all the time available. On account of this lack of pumping a set of samples was taken from the dug well which was used to supply the boiler used in the plant for drilling the deep well. This well had thus been pumped for several days but not recently, however. The sample was taken after about five minutes pumping.

RESULTS OF CHEMICAL EXAMINATION OF WATER FROM VERSAILLES.

PARTS PER MILLION.

	Driven well.	Dug well.
Number of sample.....	1086	1087
Color .....	.05	.12
Turbidity	trace	.10
Sediment	slight	slight
Odor	faint earthy	faint earthy
Oxygen required.....	0.79	1.33
N. as free ammonia.....	.016	.014
N. as albuminoid ammonia.....	.024	.037
N. as nitrates.....	11.78	7.31
N. as nitrites.....	.005	.011
Chlorine	10.8	6.9
Alkalinity	240.2	241.3
Incrusting constituents.....	80.4	24.2
Total solids.....	670.	516.
Volatile and combustible.....	341.	253.
No. of bacteria per c. c.....	2100.	7500

This matter was presented to the Board at its meeting held in Columbus, May 9th, 1900, and the Board voted to disapprove of the proposed supply. The trustees were advised to look for water in some other locality.

In August following, the Board was requested to take action in reference to a supply to be obtained from driven wells located on Swamp creek in the northwestern part of the village. The Engineer again visited Versailles on August 7th and investigated the surroundings of the well and collected a sample from one of them for examination. The sample was collected under unfavorable conditions, the trustees having failed to pump the well, notwithstanding the instructions given. The result of the examination was not satisfactory, and the trustees were so notified. At their request another set of samples was taken from Swamp creek August 21, 1900. The Engineer submitted the following additional report in reference to these wells:

On August 21st, 1900, a second set of samples was taken from Swamp creek wells. The samples, chemical and bacteriological, were taken from the west of three wells located on Swamp creek in the northwestern part of the village. Three 8-inch wells were driven 30 feet deep through 6 feet of loam, 16 feet of blue clay, and into 12 feet of gravel. The wells

were removed from direct pollution but may be in the line of the subsurface flow of the village and from the analysis so seemed to be, but from the location and geology of the place they should receive but a small portion of the subsurface flow. The sample was taken from the west well after it had been pumped for eight and one-half hours at a rate of 135 gallons per minute, or after the removal of about 77,000 gallons of water. The amount of water removed and the height maintained in the wells during and after pumping would indicate that the supply was abundant.

It does not seem probable that the wells are receiving much if any sewage pollution from their location and the character of the surroundings, but it is impossible to determine the exact trend of the subsurface flow. Around and in the neighborhood of the wells the water bearing strata are covered with a layer of clay and there are no cess-pools in use in the village, nearly every one using shallow vaults or boxes. As regards location, the present site is an improvement over the first one in that it is out of the general trend of the subsurface flow from a greater part of the village and in the fact that the gravel is covered with an impervious stratum. If the village should grow to any extent the present well site would no doubt become more thickly built over and the pollution increased.

Two other wells besides the three to be used have been drilled since the first trials were made but these were unsatisfactory. One was farther up Swamp creek than the present group, but no water was found there.

The reason for the many attempts to find water in or near the center of the village, is the fact that an electric light plant is to be put in with the water works and if the plants are centrally located it will be much less expensive piping and wiring. There seems to be no doubt but that good water could be found at a point removed from the village, but the trustees have not seen fit to search for it in any place but in the village, and now claim that if the present wells fail of approval they will be compelled to abandon their attempt.

A water supply is badly needed for both fire and domestic use, but it is doubtful whether the proposed wells will furnish the proper one.

It would further require a study of the locality to determine whether the wells are influenced by sewage and whether they now furnish a better supply than the private wells of the village can furnish.

If it is seen fit to approve the present well supply it would be advisable to approve conditionally that the present standard should not be lowered and that the trustees obtain absolute control through purchase or long time lease, with the privilege of renewing, of the land around and adjacent to the wells so as to prevent the too close approach of anything liable to pollute the subsoil water.

RESULTS OF CHEMICAL EXAMINATION OF WATER FROM VERSAILLES.

PARTS PER MILLION.

No. of sample.....	1295	1262
Color .....	.07	.10
Turbidity .....	.21	.14
Sediment	slight	considerable
Odor	none	earthy
Oxygen required.....	1.44	1.53
N. as free ammonia.....	.524	.490
N. as albuminoid ammonia.....	.093	.109
N. as nitrates.....	none	none
N. as nitrites.....	.001	.009
Chlorine	33.3	40.7
Alkalinity	372.2	379.4
Incrusting constituents.....	114.2	122.8
Total solids.....	826.	845.
Volatile and combustible.....	289.	280.
Iron	1.3	.....
Bacteria per c. c.....	8200.	.....

"Sample No. 1295 was taken from the water works well on Swamp creek after the well had been pumped for several hours by means of a steam pump. The results of sample No. 1262, taken August 7th, are given for comparison and it is seen that the present sample shows improvement in nearly all the determinations. The free ammonia comes from reduction of the nitrates and is not objectionable, while the remaining indicators for organic matter are passably good. This sample agrees well with the preceding one in alkalinity and incrusting constituents, showing the water possesses a high soap consuming power and is therefore undesirable for laundry and steam uses.

In the report on sample No. 1262, comment was made on the chlorine factor as being high for a shallow well, and which was especially noticeable because of its marked increase over the chlorine (10.8 and 6.9 parts) found in the waters from test wells located in another part of the village and reported upon last May. This fluctuation in chlorines in the same or neighboring wells of shallow depth is an unfavorable sign, and appears to be due to sewage influences. By this we do not mean that sewage enters directly into the well, but that the water before or during its passage through the soil came in contact with sewage material and the chlorine remained as a permanent character of the water. The nitrates which ordinarily remain, have here disappeared by virtue of the reduction previously mentioned. If this chlorine were from mineral sources it would pass muster, but such origin seems improbable in this case.

Duplicate and prolonged searches failed to reveal the presence of any intestinal bacteria, but the number of bacteria is far too high for a good driven well or a water to be used for a public supply, since their presence had some meaning, though no pathogenic forms were found. That a large number of organisms belong to the water and was not an

accidental result in the bacterial sample alone was shown by confirmatory tests from water taken from the chemical sample.

Had the physical properties of the water been recorded at the time of collection they would have been nearly perfect, since the water was free from turbidity and sediment at the time of collection, but on aeration and standing developed the appearance recorded.

To sum up then, the objectional features in the analytical findings are the appearance, hardness, chlorine and the number of bacteria. The first two of these would be noticed by consumers and would give rise to complaint; the last two would not be realized by the consumer but rather are indicators of conditions which may become so altered subsequently as to be detrimental to the health of the consumers."

At a meeting of the Board held in Columbus, October 17th, it was voted to approve the water supply for Versailles, to be obtained from driven wells located on Swamp creek, and notice of the Board's action was sent to the Secretary of the Water Works Trustees of Versailles, November 1, 1900.

REPORT ON WATER SUPPLY FOR WAYNESVILLE.

Application having been made to the Board for the approval of a water supply for the village of Waynesville, Warren county, the Engineer was requested to make an examination. He reported as follows:

Waynesville is a small rural village with an estimated population of 850 and with practically no industries outside of the commercial line. The installation of a water supply is desired on account of the difficulty in securing good private well water, but especially on account of the disastrous fire which the village experienced last year.

It is desired to put in a combined water and light plant, and bonds for \$30,000 have been voted for, sold, and the money is now available. The work is being done under the direction of council, no trustees have been elected as yet.

In the search for water 4 six inch wells have been put down as follows:

*No. 1, located in the northern part of the village, was put down 78 feet, in rock nearly all the way and but little water found.

No. 2, on high ground in the west side of village, was put down 78½ feet through soil and into limestone and but little water found.

No. 3 and No. 4 are located just south of the village in the low ground between the hills and the river. No. 4 was put down 47 feet in all through 29 feet of soil and clay and through 18 feet of fine water bearing sand. The supply of water from this well seemed to be plentiful but the sand was too fine to screen. No. 3 is 50 feet deep and only 75 feet from No. 4, but it goes through 15 feet of soil, 9 feet of coarse gravel, 9 feet of sand and 18 feet of limestone. The water is found in the sand

and gravel above the rock. The water stands about five feet from the surface and a 24 hour test of this well at the rate of from 70 to 100 gallons per minute failed to lower the water to any great extent, certainly not below the suction limit.

On the day of the inspection a six hour pumping test was made at the rate of 75 gallons per minute, with like results.

From all appearances the quantity of water available seems to be sufficient, but on account of the variation in the water bearing strata, careful tests must be made to determine the proper number of wells and their economical location.

The well site is removed from all local pollution except that from two vaults, each about 50 yards from the present wells, but one of which is within a few yards of the water works lot in which the other wells must be put down. It would be well to have these provided for as the water bearing strata do not have an unbroken impervious covering. The land is overflowed by extreme high water, and it is intended to fill in so as to bring the property above this line. To prevent stagnation of water in the fill it should be well tiled.

From all that can be learned the wells will furnish an acceptable water as far as appearances go.

It is proposed to pump water direct from the wells to a standpipe. For fear that the wells might not be able to meet an extraordinary demand for water as in case of fire, the council requests that a permit be granted for an emergency suction line to the river, about 500 feet away. If this permit is granted there will be need for fewer wells at present and construction would be cheapened a little. A sudden demand for a large quantity of water can be supplied by an extra number of wells or by fewer wells and a large storage cistern, either of which would be more desirable than the river connection, but not as cheap.

RESULTS OF CHEMICAL EXAMINATION OF WATER FROM WAYNESVILLE.

PARTS PER MILLION.

No. of sample.....	1426
Color .....	.07
Turbidity	trace
Sediment	trace
Odor	faint
Oxygen required .....	.59
N. as free ammonia.....	.010
N. as albuminoid ammonia.....	.042
N. as nitrates.....	4.02
N. as nitrites.....	trace
Chlorine	3.8
Alkalinity	249.2
Incrusting constituents.....	none
Total solids.....	376.
Volatile and combustible.....	72.
Bacteria per c. c.....	180. no colon

"The water is of good appearance, is comparatively free from organic matter, does not show a large amount of past pollution, and it is not a hard water for this state. The number of bacteria is not high, and would probably show a falling off after the well had been in use."

The Board voted to approve the proposed water supply for Waynesville to be obtained from wells as indicated in the above report, but disapproved the proposal to establish an emergency suction line to the river. Notice of this action of the Board was sent to the village council November 1, 1900.

REPORT ON PROPOSED WATER SUPPLY FOR ZANESVILLE.

The water works trustees of the city of Zanesville made application to the Board for approval of a new water supply for that city, to be obtained from wells opposite the present power station and adjacent to the Muskingum river. The matter was referred to Dr. J. C. Crossland, as a committee of the Board, to investigate and report. Dr. Crossland reported as follows:

The city of Zanesville is now obtaining its water from the Muskingum river. This water usually contains, in suspension, a large amount of clay. In short the physical properties of the water are almost intolerable and are growing worse.

On the west side of the river, opposite the power house, lies a large tract of comparatively low land one mile or more in length and, at the point of proposed location of wells, about eight hundred feet in width.

This territory is uninhabitable because of its occasional overflow by the river, and is used for agricultural purposes. Beyond this bottom is a strip of level land several hundred feet in width, and beyond this a hillside and bluff. This locality is sparsely inhabited. About half a mile north of the well site and situated on the bench is an immense tile works employing from seven hundred to a thousand people. The sewage and waste from this factory empty into dry wells. These dry wells are about half a mile from the proposed well site. The C., C. & C. railroad owns and occupies a strip of one hundred feet in width along the river.

It is proposed to purchase a strip of land west of the C., C. & S. railroad about three hundred feet in width and one thousand feet in length and put down sufficient eight inch drilled wells to produce an adequate supply. One well has been drilled to a depth of sixty-three feet.

The geological formation is coarse sand and fine gravel from top to bottom. This formation is believed to be general throughout the bottom. It is believed to have been at one time the river bed. The test well was drilled about one hundred and seventy-five feet from the river, and was pumped continuously for twenty-six days at the rate of 500,000 gallons per day. The pump was insufficient in size to determine the maximum capacity of the well. Three samples of the water from the well

have been secured at different times during the pumping, and analyzed. (See chemist's appended report). Copies of analyses of samples of the present supply at the power house station are also appended for comparison with the analyses of the proposed well supply. These speak for themselves and need no comment from me.

The daily consumption is about 5,000,000 gallons, and it is proposed to drill as many wells as may be needed.

A small engine house is located adjacent to and about the middle of the strip of ground. There is here a vault or dry well. The shop has been abandoned for a year or more and when used again the vault could be placed on the river bank. This water is not river water, but ground water. The analyses confirm this view. If it was thought that the pollution on the higher ground west of the bottom might in time pollute the wells this could be prevented by a sewer on Central avenue, the first street on the higher ground beyond the bottom. If it is thought possible for the dry wells at the tile works to endanger the supply there could be no objection to emptying the sewage from said plant directly into the river, or it could be carried away by an extension of the suggested Central avenue sewer.

However, in the present condition of things I do not apprehend one iota of danger from either source. Nevertheless there might develop in time conditions making these sewage disposal provisions necessary.

Conclusions: 1. The water is wholesome and adapted to the various purposes. 2. It is by tests far superior to the present supply. 3. The supply is seemingly adequate and permanent. 4. There are no present or probable imprevmentable future sources of pollution. 5. It seems to be the most economic plan feasible.

In view of the above conclusions I recommend approval of the supply, and also recommended that its approval be accompanied with a suggestion that the wells be not less than 150 feet apart.

RESULTS OF CHEMICAL EXAMINATION OF WATER FROM ZANESVILLE.
PARTS PER MILLION.

Date of collection.....	Oct. 10	Oct. 25	Nov. 5	Nov. 20
Number of sample.....	763	809	811	848
Color .....	.05	none	none	none
Turbidity	slight	trace	none	none
Sediment	slight	trace	none	none
Odor	faint of machine oil	faint of machine oil	none	none
Oxygen required.....	1.03	.63	.39	.81
N. as free ammonia.....	none	none	.003	.004
N. as albuminoid ammonia....	.005	.020	.016	.009
N. as nitrates.....	trace	.28	1.65	trace
N. as nitrites.....	.024	.004	trace	2.23
Chlorine	2.5	2.6	2.5	2.7
Alkalinity	186.8	186.4	145.8	145.8
Incrusting constituents.....	37.4	48.8	58.0	57.8
Total solids	332.	313.	277.	291.
Volatile and combustible.....	85.	74.	51.	58.
Iron	1.1	trace		

"Sample No. 809 was taken after three hours of pumping, and is on the whole slightly better than the earlier sample. To simplify matters the results of this sample will be discussed as it was taken under better conditions.

The amount of organic matter as shown by the oxygen requirement and the nitrogen determinations is rather low. The small proportion of ammonia shows that oxidation of the organic matter has been efficient. The low chlorine shows that there has been very little if any pollution from sewage — and if any, it must have been remote in time or distance as shown by the condition of the nitrogen. The hardness of the water in the Muskingum river varies considerably, but has, at times of our tests, been softer than the water from this well. The well water is of medium hardness. In reference to the origin of the well water, the results would indicate that the water of the well did not come from the river at this point. The indications are found in the lower chlorine of the well water, and on the other hand, the slightly greater hardness of the well water.

In its present condition the water of the well is a great improvement over the Muskingum river, as shown by our river work. The chemical findings would allow this water to be used — but I should say the use of this water depends much on the probability of future pollution of the neighboring soil, assuming that the water is not filtered river water — and as stated above the indications are that it is not from the river at this place.

Sample 811, taken after twelve days pumping. The continued pumping has yielded a water with no turbidity, sediment or odor. The present sample is slightly lower in alkalinity, total solids, oxygen requirement, and especially the nitrites. The ammonias and chlorine remain practically the same. There has been a slight increase in incrusting constituents. The amount of nitrogen as nitrates has considerably increased. This indicates the presence of some organic matter in the past. This organic matter must have been vegetable in nature, for had it been sewage, there would have been likewise an increase in the chlorine, which is not the case.

The analysis indicates this water in its present condition to be a potable one, as the organic matter it has contained was of vegetable origin and has furthermore been oxidized to mineral form. Were the water free from nitrogen as nitrates it would of course take a little higher rank.

It takes a very brief comparison of the results of this analysis with those of the river samples taken from the Muskingum at the Zanesville intake to see that this water is far preferable to the river water. While the water in its present condition is a safe one, I cannot say it would continue so were the neighboring soil to become polluted provided there

are no impervious strata of clay above the level from which the water is taken.

Comparing sample 848 with sample 811 I find the two analyses are almost identical. The oxygen requirement of sample 848 has increased to .81 parts per million, but this is a reasonable figure. The nitrates also are higher in this sample, being 2.23 parts per million, and constitute the only objectionable feature from the analytical standpoint. The failure of the chlorine to increase with the nitrates substantiates the position previously taken, viz.: that the nitrates represent vegetable organic matter and not sewage contaminations. I find no reason for changing my opinion that from the analytical side nothing appears to show that the water would not be a safe and satisfactory one. This well water is slightly harder than the average of our river work samples above Zanesville.

RESULTS OF CHEMICAL EXAMINATION OF WATER FROM ZANESVILLE.

PARTS PER MILLION.

Date of collection.	April 29.	May 23.	June 21.	July 27.	Aug. 31.	Sept. 28.	Oct. 18.
Number of sample.....	401	461	507*	598	666	736	789
Color .....	.2	.25	.25	.25	.25	.3	.25
Turbidity .....	.40	.90	3.30	1.00	.48	.90	.26
Sediment	con.	con.	con.	con.	con.	con.	con.
Odor	none	faint ear.	earthy	earthy	musty	earthy	earthy
Oxygen required	5.31	13.16	11.76	5.26	4.36	4.71	3.33
N. as free ammonia.....	.086	.046	.124	.041	.066	.042	.066
N. as albuminoid ammonia ..	.174	.320	.764	.228	.226	.179	.144
N. as nitrates .....	.12	.06	.09	.05	.08	.02	.04
N. as nitrites.....	.006	.009	.001	.005	.004	.005	.014
Chlorine	2.6	3.6	1.1	9.5	9.7	16.1	21.1
Alkalinity	93.0	78.9	51.7	95.8	166.6	137.0	145.8
Incrusting constituents.....	80.4	45.5	30.4	21.6	23.2	43.2	14.8
Total solids	303	424	1361	363	328	440	
Volatile and combustible.....	102	81	141	101	105	100	

*Muddy from rains.

Samples taken from Muskingum river at City intake.

The question of approving this supply was brought before the Board and the supply was approved, with the suggestion that provision be made by proper sewerage for the district to prevent any possibility of future contamination of the water.

This plan for obtaining a new water supply, for reasons which need not be stated here, was abandoned.

At a meeting of the Board, held October 17, 1900, a committee of the council of Zanesville, in behalf of the council, and the city engineer, presented plans for a change in their water supply, viz.: the installation of a system of mechanical filters for the purification of the present system, taken from the Muskingum river.

The plans were referred to a committee for further investigation. Legal complications in reference to the proposed changes in the water supply of Zanesville having arisen, the question of approving the plans has remained *sub judice*.

SEWERAGE SYSTEMS AND SEWAGE DISPOSAL.

REPORT ON PROPOSED SEWERAGE FOR THE PROPERTY OF THE COLUMBIA CHEMICAL COMPANY AT BARBERTON.

The Columbia Chemical Company at Barberton asked for the approval of plans for discharging sewage into Hudson run. In their application they stated that the sewage would come from some eighty small houses on the property of the company. Gagings made of the run showed, it was claimed, a minimum flow of 3,000,000 gallons in twenty-four hours. The proper authorities of the village of Barberton had recommended that the Company be given permission to use the run as desired. It was claimed that it was impossible on account of levels to make use of the the sewerage system of Barberton. The engineer made an investigation and reported as follows;

Upon the request of the President, I visited Barberton on August 3rd, and the proposed system was gone over in company with H. A. Gault and F. E. Dussel, representatives of the company. The Chemical Company is erecting a large plant, just southwest of Barberton, for the manufacture of soda-ash.

The sewage and waste water from the plant proper is to be discharged into Wolf creek about one-half mile above the Barberton sewer outlet. Application was not made for the approval of this outlet owing to the ignorance of the law on the part of the company officials.

It is expected to employ about 300 men in the works and to use about 5,000,000 gallons of water per day, 1,000,000 of which is to be obtained from a well and the remainder from Wolf Creek. The creek will be dammed and a small amount of water impounded, but the bulk of the supply will have to be supplied by the daily flow of the stream. The sewage and waste water will enter the creek just below the dam.

The sewer, for which application was made for the approval of its outlet, is to drain 75 dwelling houses which are being erected by the Company for the use of its employees. The houses are located just southwest of the plant in the valley of Hudson run and will probably shelter about four hundred people. The water supply for both the houses and the sewers will be furnished by the Company. It is desired to empty the sewage into Hudson run at a point 5,000 feet above where the latter empties into Wolf creek. As Wolf creek is already polluted with the sewage of Barberton it must be determined whether or not the additional amount of sewage will cause a nuisance.

In regard to the sewage of the works proper, which will empty into Wolf creek, it will probably be found that no nuisance will be caused owing to the extra amount of water added to the creek. This

may not be true for a great length of time as Barberton is now sending in nearly all the sewage the stream will stand and at times more than it can easily dispose of.

From July 20th to August 7th, 1899, the Company had both Wolf creek and Hudson run gaged roughly by means of surface floats and the average flow was estimated to be as follows:

Wolf creek, 11.36 cubic feet per second.

Hudson run, 4.40 cubic feet per second.

These figures were taken from the minimum flow of the streams, but are not correct unless the streams depart widely, in character of flow, from several other Ohio streams which have been carefully gaged. In every case it has been found that the average minimum flows occur in September and October and not as early as July and August.

The areas of the two watersheds in question, as determined by planimeter measurements on a large county map, are as follows.

Wolf creek, 75 square miles.

Hudson run, 13 square miles.

The rainfall on the areas was determined from the records of the weather bureau kept at Wooster, Medina and Akron. With these data and with the ratio of runoff as determined by the Ohio results, the following table was prepared:

1899.	Rainfall in inches.	Ratio of runoff in per cent.	Runoff in cubic feet per second.	
			Wolf creek.	Hudson run.
July	3.65	.03	7.12	1.23
August	1.60	.12	13.12	2.28
September	4.26	.01	3.23	0.56
October	2.58	.01	1.72	0.30

The average results for July and August are below the estimate made by the Company for the portion of these months. The small size of the watersheds, together with the swampy nature of a portion of them, would tend to increase the percent of runoff to nearer the figure given by the Company and also to make the flow more uniform.

According to Hazen it requires a flow of from 1.5 to 4.0 cubic feet per second to dispose of the sewage of 1,000 people without causing a nuisance. With this estimate it is seen that Hudson run will hardly care for the sewage of 400 people in September and October and that Wolf creek is now doing all that it can with the sewage of some 3,000 people at Barberton.

Considering the fact that the local conditions may increase the above estimate of the flow, it is respectively recommended that the

Columbia Chemical Company be allowed to send the waste water and sewage from their factory into Wolf creek and the sewage from the collection of dwellings into Hudson run in accordance with the written request and blueprint as submitted by the said Company, provided that if at any time the sewage from either source shall cause a nuisance in either Wolf creek or Hudson run, some other provision for caring for the sewage shall be made as required by the State Board of Health.

The Board voted to approve of the outlets for the proposed sewerage system upon the condition that the Company should file an agreement with the Board to the effect that, if at any time the sewage should be the cause of a nuisance, some other way of disposing of the sewage would be provided which should be satisfactory to the State Board of Health.

Such an agreement having been filed, notice of approval was given.

REPORT ON SEWERAGE FOR BOWLING GREEN.

At a meeting of the Board held in Columbus, Oct. 17th, 1900, Mr. H. E. Riggs, Consulting Engineer for the city of Bowling Green, and the City Solicitor of that city, presented plans for a system of sewerage for Bowling Green as follows:

In submitting these plans we desire to make a statement as to the former action of the council relative to sewerage and place at your disposal information as to the local conditions.

Bowling Green is the county seat of Wood county. It has a population closely approximating 9,000. It is located on a knoll or rise of ground in the central part of the county, about four miles from the Portage river and about nine miles from the Maumee river.

As shown by the profiles and topographical map, there is sufficient fall in the built up section of the city to enable us to establish a system of self-cleansing sanitary sewers, with a gravity outlet, to a point in the northeastern portion of the city. From any point in the vicinity of the T. & O. C. R. R. and the Poe run to the Portage river about four miles east the fall is very light, being not to exceed three feet per mile.

In 1896 the writer was employed by the city council to make an examination and report on sewerage. The work was done and the writer recommended the separate system with a pumping plant located near the present temporary outlet, pumping the sewage to a sand hill about a mile north and there purifying by means of intermittent filtration. This report was received by the council and the matter of bonding submitted to the people and by them almost unanimously defeated. At a subsequent date a report was made by Mr. F. Herbert Snow in which

all of the recommendations in the first report were endorsed. At this time also the people were against the improvement.

The matter was brought up this year and the firm of which the writer is a member was employed to prepare plans and specifications. The work was completed a few weeks ago.

Before entering a description of the plans a few words may be appropriate as to the present sanitary condition of the city. The outlet for all the sewers at present is an open ditch running along the north city limit and discharged into Portage river known as the Poe ditch. On the extreme east of the city there is a north and south ditch known as the Crim ditch, which carries off a large portion of the surface water, but which receives no sanitary sewage, as the portion of the city tributary to it is but thinly settled and will probably have no considerable population for many years to come. This section of the city is not included in our present plans. A north and south ditch near the Ohio Central Railroad, running from the Poe ditch to a point about half a mile south is known as the Thurston ditch. This ditch is the outlet at present of one or two sewers, which carry the surface water from the section of the city east of Main street. These sewers carry a small amount of kitchen drainage and possibly other sanitary sewage. The ditch is at present somewhat polluted, but it is in no sense a nuisance.

On the west of the city discharging into the Poe ditch near the fair grounds is a ditch known as the Gorrill ditch. This ditch extends south and takes the drainage of not only the eastern half of the city but of several thousand acres of flat land lying south of the city, known locally as "Lake Erie."

For a distance of some 1,300 feet this water way has been covered and from the Ohio Central station to the fair grounds, it is in the form of a thirty-inch single ring brick sewer.

The Gorrill ditch is fearfully polluted. Sewers emptying into it at one or two points in the brick sewer; also at Pearl street and at Ordway street to the south of the brick sewer.

By reference to the map it will be seen that the Ordway street sewer which empties at the extreme southeast of the city limits discharges sewage into a small open ditch which runs for nearly two miles through the city before it reaches a point where it is in unsettled country. These sewers all carry a very considerable amount of house sewage. The condition of the Gorrill at the outlet of the brick sewer at the fair grounds is in hot weather unspeakable.

The sewers that are in existence now are all shown on map. They consist of small pipe sewers without cemented joints at a depth of from three to five feet below the surface. No engineer was employed in their design. The matter of grade received little or no attention and they are no credit to those having in charge their construction and are not worthy to be classed as sewers.

The soil at Bowling Green is a yellow sand partaking largely of quicksand; at a depth of from three to eight feet is solid limestone rock. The rock stratum rises near Wooster street, forming a basin south of that point which holds a large amount of water, causing wet cellars and a general unsanitary condition.

The writer when at Bowling Green took into account, first: The necessity of doing something immediately to relieve the present unsanitary condition of the city. Second: The desirability of doing away with all sewage outlets on the west and southwest portions of the town, and bring all sewage to the one common point where sewage purification works can be established. Third: The necessity of the establishment of sewage purification works in the future. This is a condition from which there is actually no escape. Fourth: The opposition of the voters to bonding the city, which feeling of opposition has resulted in the defeat of the sewer question whenever submitted to the people. Fifth: The possibility of establishing the system of sewers without submitting the matter to a vote.

I have therefore recommended to the council and I recommend to you that the system as planned be constructed. The plans provide for a separate system, the sewers shown being designed as sanitary sewers. The main outlet on Leroy street east of Main to be used temporarily for the admission of a limited amount of storm water from the Main street paving district, but otherwise the system can be maintained as a house sewage system and later all storm water cut out of it. Storm water can be provided for by other sewers leading to the Thurston, Gorrill and Poe ditches.

Ultimately some form of sewage purification must be adopted and the writer is still of the opinion that the only desirable solution of this problem is the establishment of a pumping plant at a point near the present outlet. An independent pumping plant may be established or an electric power pump may be used; sewage to be pumped to the sand ridge before mentioned.

The Common Council has taken advantage of the provision of the law which will enable them to build main sewers and assess the cost on the property benefitted. This obviates submitting the matter to the people at an election as special assessment bonds will be issued. The sewage disposal works cannot be included in this legislation and it is evident from the feeling on the part of the tax payers that any proposition to bond for the construction of the disposal plant, before the main sewers are completed, would be defeated. I have therefore recommended that no action be taken at present regarding sewage disposal works, but that your approval be asked for a temporary outlet in the Thurston ditch at Leroy street subject to the condition that sewage purification be established five years from this date, or at such time prior to five years, as the State Board of Health may order, if the discharge of sewage at such temporary outlet shall create a nuisance.

The writer has been selected by the City Council to present the matter to your honorable body. I therefore ask your approval of the plans as submitted, i. e., a temporary outlet at the point named and under conditions just mentioned. The reasons which I would advance are as follows: 1st. Sewage purification may be secured after the main sewers are completed and when lateral construction is under way. 2nd. The sanitary condition of the city will be greatly benefitted by the construction of sewers shown on the plans and by removal of all sanitary sewage from the Poe and Gorrill ditches above the outlet of the Thurston ditch.

The Board voted to approve these plans subject to the following conditions:

First, that present sewers now in use be abandoned for carrying house drainage.

Second, that provision be made for purifying the sewage in a manner satisfactory to the State Board of Health within three years' time from the completion of the main outlet sewer.

A notice to that effect was sent to the City Council of Bowling Green on November 1st, 1900.

REPORT ON PROPOSED SEWER SYSTEM FOR CANAL DOVER.

The following letter was received January 31, 1900, signed by the Mayor, City Solicitor and Engineer in charge of the work, in reference to a sewer system proposed for the village of Canal Dover:

By resolution of the village council, duly adopted on January 24th, we herewith present outline plan, showing the proposed sanitary system of sewerage for the central portion of the village of Canal Dover, Ohio; and ask your approval of the proposed location of the outlet sewer into the Tuscarawas river at the point shown below the C. & P. R. R. bridge, and between the canal and the river. It is proposed to use this outlet until such time as in your opinion some method of purification will become necessary, and when such time comes to install some modern method of purification available at such location. The tract of land between the canal and the river, being shut off from all possible habitation, is considered desirable for such an outlet and also suitable for the location of a garbage crematory. The Tuscarawas river at this point is held back by a dam about 8 feet high, and located $1\frac{3}{4}$ miles below this point. While in some cases it would seem desirable to go below this dam with the outlet sewer, yet, owing to the low level of the ground, this is not possible without pumping the sewage, and such pumping would entail such an expense as to defeat the project for sewerage which is badly needed in the business parts of the town.

We trust this may meet with prompt action on the part of your Board.

Upon receipt of this letter the Engineer was sent to Canal Dover and reported as follows:

Canal Dover is situated on a thick bed of sand and alluvial deposit, the major portion of which is from 30 to 40 feet above mean low water in the Tuscarawas. The surface drainage is to the above river, to Sugar creek, and to "Calico" Power ditch, which is fed from Sugar creek. Most of this drainage is carried off in the gutters, with a few short stretches of tiling in low places.

A public water supply was put in during the winter of 1893-4, which now has about 342 services in or 2000 people using same. The average daily consumption is about 60,000 gallons or 30 gallons per capita for the population actually supplied. There are about 15 water closets in use, the remainder of the population using outdoor vaults. These are never cleaned and the sub-soil water is very much polluted. There is no doubt but that the village needs a sewer system, and needs it badly.

It is proposed to put in the separate system, only the sanitary part of which is to be built now, the gutters being left to take care of the storm water as formerly. Plans are to be prepared for the whole village but it is intended to sewer only the central or business portion at present, leaving the remainder to be put in later on. The portion above mentioned includes the district bounded as follows: south and west by the Tuscarawas river and the Power ditch, north and east by Sixth or Seventh street and Wooster street.

Canal Dover has an estimated population for 1900 of 5453, of which one-third, or 1800 are included in the sewer district.

The proposed outlet is into the Tuscarawas river just below the entrance point of the Power ditch from Sugar creek, and well within the back water of a dam opposite New Philadelphia. This gives a great quantity of water in which to empty the sewage but cuts down the velocity of the stream, though in this case, owing to the nature of the dam and the power plant there is always some current. The dam is one and three-eighths miles below the sewer outlet and it backs the water up about two miles. It is 6 feet high, 250 feet long, and is constructed of rough stone work, leaking badly at all times. The dam diverts water to a race one and three-fourths miles long which furnishes power to an electric plant below in New Philadelphia. This plant has three Loeffel turbines, two of which are 56 inches in diameter and rated at 174 horse power with 10 feet head and the other is 45 inches in diameter and rated at 129 horse power. The full power cannot be obtained owing to the difficulty in getting the tail water away. The auxiliary steam plant has 350 horse power and at least this same amount is obtained from the water power. It is claimed that there is but seldom a lack of power from low water, a few days each summer only. On this supposition the minimum flow approximates 400 cubic feet per second,

allowing a high efficiency for the plant. This figure seems high for the average minimum flow of this stream but it is not an impossible one. Assuming an inch of rainfall on the watershed, 1400 square miles, for the month of August, and 30 per cent. running off, the average flow per second would be 400 cubic feet, the figure above. As it is claimed that the flow but seldom goes under this amount, the river can easily dispose of, by dilution, all the sewage of Canal Dover without causing a nuisance.

The first public water supply to be taken from the river direct is that of Zanesville, 115 miles below.

Enclosed as a part of this report was a blue print map showing the location of the sewers and the point of discharge.

The matter was submitted to the Board and the plans, with an outlet into the Tuscarawas river at a point below the C. & P. Railroad bridge and between the canal and the river, were approved subject to the condition that the village of Canal Dover, whenever required to do so by the State Board of Health, should purify its sewage in a manner satisfactory to said Board. The village authorities were so notified February 20th, 1900.

ADDITIONAL SEWERAGE FOR GORDON PARK, CLEVELAND.

The Board of Park Commissioners of Cleveland, in April 1900, made application to the Board for approval of the construction and outlet of a sewer in Gordon Park to be located in Gordon Park avenue with outlet into Lake Erie, and furnished plans showing the route of the proposed sewer. As a part of their request they also entered into the following agreement, to-wit: "It being distinctly understood and agreed that when the proposed intercepting sewer is built by the city of Cleveland according to plans already approved by the State Board of Health, all house sewage will be directed from Gordon Park avenue sewer into the said intercepting sewer."

It was voted by the Board to approve the construction and outlet of the sewer for Gordon Park in consideration of the agreement noted above, and notice was sent to Mr. George F. Hoffman, Secretary of the Board of Park Commissioners, May 10, 1900.

REPORT ON ADDITIONAL SEWERAGE FOR CONNEAUT.

Mr. B. F. Hewitt, Engineer for the village of Conneaut, appeared before the State Board of Health at a meeting held May 9th, 1900, and presented plans for the construction of a sewer in District No. 3, in said village, with an outlet into the Conneaut river; said outlet being shown

upon map furnished with said plans. He asked the Board to approve the plans and also to approve changes in the outlet of the Park street sewer; namely to construct the Park street outlet of sufficient capacity to relieve the territory which lies south of Park avenue and between Harbor and Broad streets from the storm water which at the present time flows into the lake at the point where the intake to the water works is located. Accompanying the plans were specifications for sewers to be constructed.

The Board voted to approve plans presented by the engineer of Conneaut, but with the provision that sewage purification works for the proper purification of the sewage of Conneaut should be constructed whenever this should be deemed necessary by the State Board of Health. Notice of this action was sent to the mayor and council of that village, May 10th, 1900.

REPORT ON PROPOSED SEWERAGE FOR DELAWARE.

A request was received from a committee on sewerage of the Board of Trade of Delaware that a representative of the Board visit that city to look over the ground and examine plans in reference to the introduction of a sewerage system. Accordingly on July 11th, 1900, Dr. Frank Warner, as a committee, accompanied by the Engineer, Mr. Flynn, visited Delaware. They submitted the following report:

Delaware is a beautiful college town with an estimated population of 9,000. Its surface drainage is cared for by gutters and a few short storm sewers which empty into Delaware run and the Olentangy river. A new storm sewer is now being put in. It is claimed that all districts will be well cared for as far as storm drainage is concerned, when it is completed.

The next problem to be taken up is a sanitary sewer system. As the storm drainage is fairly well cared for, it was thought advisable to put in the separate system of sewers; and the committee of the Board of Trade wished to know what would be required of them in regard to the disposition of the sewage. In order to put in the system at once, as it is badly needed, they wished to be allowed to empty raw sewage into the Olentangy river at some convenient point below town.

There is no doubt that sanitary sewers are badly needed in Delaware; many buildings now have private sewers to the run and to the river and many other places are in poor sanitary condition from lack of sewer facilities. A proper system of sewers with an outlet below town would benefit the sanitary condition of Delaware and improve the condition of Delaware run and of the Olentangy river opposite the corporation; but the sending of raw sewage to the river would be quite serious to the people below Delaware, and especially to the

citizens of Columbus, 24 miles below. The water of the Olentangy river is now used raw for the water supply of Columbus when ever the gallery and Scioto river supply runs short, according to a statement made to the Committee by the Superintendent of the Columbus Water Works. This use of the Olentangy river water is not regular but whenever there is any extraordinary demand for water or in case of accident to the collecting system of the other supplies, it is necessary to turn the Olentangy river to tide over the emergency. The water supply for Columbus is now being investigated by a consulting engineer who may recommend a supply from the Olentangy, or from a source entirely foreign to the same; but as long as the pumping station is located on the banks of the Olentangy and the present intake is maintained, there is always a possibility that the Olentangy river water will be used during emergencies.

Besides the danger to the water supply of Columbus; it hardly seems proper to allow the pollution of this river when Columbus is now studying the question of purifying its own sewage so as to cause no nuisance below the city.

Delaware itself will have to contend with the question of local nuisance. According to Allen Hazen, Delaware is in the doubtful column as regards a nuisance from its own sewage but his figures were based on a dry flow of 0.1 cubic feet per second per square mile of drainage area while an accurate gaging of the Olentangy river at Columbus in 1899 shows that for the months of September, October, and November, the actual runoff is from 0.1 to 0.8 less than the estimated flow, and during the months named the sewage would no doubt cause a nuisance, if it did not do so during the summer months also. The proposed sewer outlet will be at the C. S. & H. R. R. bridge across the Olentangy where the river has a good fall over a flat rock bottom, but the conditions are not considered favorable enough to expect no nuisance from the emptying of raw sewage into the stream.

The investigation was not carried far enough to make a report on the chance for a purification plant. There is an old gravel pit on the line of the sewer and a broad loamy field farther down, both of which might offer a favorable site for a disposal works but nothing definite can be stated as no detailed investigations have been made along this line.

Considering every phase of the question, your committee respectfully recommends that it is hardly advisable to allow raw sewage to be emptied into the Olentangy river at Delaware and would further recommend that the officials of said village be required to seek some method of purifying their "sanitary" or house drainage before it is to be admitted to the stream.

This report and its recommendations being approved by the Board, the Committee of the Board of Trade of Delaware was so notified July 26th, 1900.

REPORT ON SEWERS PROPOSED IN SEWER DISTRICT NO. 5, EVANSTON.

An application was received from the village of Evanston for the approval of plans for Sewer District No. 5 in such village. Dr. Byron Stanton, who was appointed a committee to investigate, visited Evanston on August 1, 1900, and reported as follows:

The territory lies contiguous to Walnut Hills and Avondale, Cincinnati, and embraces nearly all that part of Montgomery road in the corporate limits and all of that part of the village to the northwest of said road. The sewers are to be on the combined system and the plans contemplate about 800 feet of brick sewer through a ravine on private grounds to connect two existing stone sewers, and about 12,000 feet of vitrified pipe sewer from eight to eighteen inches in diameter.

As shown by the plans submitted, all of the sewers will connect with sewers already constructed by the city of Cincinnati in the ravine known as Bloody run, a ravine that receives much sewage from Walnut Hills and other of the eastern parts of this city. Bloody run is a tributary of Mill creek and the discharge into it of the sewage of Evanston would add but a small proportion to the amount of sewage carried by that great open sewer, which in the near future must receive the attention of the authorities of the cities and villages along its banks now discharging sewage into it.

I would recommend the approval of the plans proposed upon condition that the village of Evanston will agree to purify its sewage in a manner satisfactory to the State Board of Health whenever deemed necessary by said Board, or join with the city of Cincinnati and other corporations interested in plans to purify the sewage or divert it from Mill creek when authorized by legislative action.

The question was submitted to the Board and it was voted to approve plans proposed for Sewer District No. 5 of Evanston, but upon the condition, to-wit; that the village of Evanston will agree to purify its sewage in a manner satisfactory to the State Board of Health whenever deemed necessary by said Board, or join with the city of Cincinnati and other corporations interested, in plans to purify the sewage or divert it from Mill creek when authorized by legislative action.

Notice of this action was sent to the Mayor and Council of Evanston, August 24th, 1900.

REPORT ON SEWERAGE FOR GREENVILLE.

At a meeting of the State Board of Health held on January 24th, 1900, the Mayor, City Clerk, City Engineer and Members of Council of the city of Greenville presented plans for a sewerage system for that city, which they asked to have approved. In support of their request they presented the following communication:

In 1896 the Council of the City of Greenville, Ohio, had Mr. John P. Force then of Fostoria, Ohio, prepare plans and specifications for a system of sewerage for the city, which plans were approved by your Board. On January 19th, 1897, Mr. Force, acting for the city, asked permission to modify the plans by dispensing with the disposal works with the exception of the screen chamber and filter beds. This modification was granted by your Board and a vote of the citizens was ordered to be taken on the proposition of bonding the city for its construction. The measure failed to receive the necessary number of votes.

In 1898 a second vote was taken and it again failed to pass. One of the principal objections used each time in opposition to the construction of the sewer was the extra expense necessary in providing this means for the disposal of the sewage. A large number of the citizens of the city on November 20th, 1899, presented a petition to the city asking that the proposition be again submitted to the people, and further asked that the council have such changes and modifications made as would be more acceptable to the wishes and needs of the city. The City Council on the same day appointed a committee consisting of six citizens and four members of Council to investigate, prepare and submit such plans for a sewer system as would best meet the wants of our city. This committee has carefully gone over the plans of Mr. Force, and desires to use these plans with the omission of the screen chamber and filter beds. We ask your honorable body to allow such change to be made in said plans and that the construction of the same be dispensed with for a limited time, say four or six years.

Our conditions are favorable for the successful operating of this sewer without these appliances. Greenville creek runs around the city proper on the west and north sides. The point on this creek where the disposal works are to be located and where the sewer crosses the creek is below the city and there are no close habitations for over one and a half miles below this point. The adjacent land is marshy and much of it is not under cultivation, and subject to overflow. The amount of water flowing in the creek is at all times amply sufficient to properly take care of all the sewage that will be discharged during the period asked for.

We do not estimate that there will be over three hundred houses tapped into the sewer at the expiration of six years, and for the first two years, not over one hundred.

From the nature of the land in the vicinity of the outlet of such sewer in the creek, it will not be difficult to procure when wanted, all the land necessary for such disposal works at the end of this period, as it can only be used for agricultural purposes and is subject to overflow.

In view of the fact that the erection of this means of disposal was the principal cause which led to previous defeats, we urge your Board to grant our request for their temporary omission, and we pledge our-

selves so far as we are able, to have the city construct the screen chambers and filtering beds at the end of the period or sooner, should your Board find that their construction is necessary. We are particularly anxious that the proposition for the construction of this sewer should carry at this time, as our city has under contract considerable street paving, and we desire to have the sewer system constructed before any considerable amount of this paving is done.

We attach hereto, a plat of the outlet and vicinity, prepared by the city engineer.

It was voted at that meeting to approve said plans subject to the condition that within a period not to exceed five years from date, arrangements should be made for the purification of the sewage in a manner to be satisfactory to the State Board of Health.

In July, 1900, a petition, with two hundred and forty-six signatures attached, was presented as follows:

The undersigned represent that they are citizens of the county of Darke (and Miami), and State of Ohio, and are property owners and tax payers, of said county, and reside along and in the vicinity of Greenville creek below the city of Greenville, Ohio; and they hereby protest and remonstrate against the proposed action to construct a sanitary sewer for said city under plans whereby the entire sewage of said city will without purification be deposited in said Greenville creek, whereby the waters of said creek will become polluted and full of disease germs and rendered impure and unwholesome; and the air tainted with foul odors and pestilential vapors, and thereby destroy the use of the waters of said creek for all useful and domestic purposes contrary to immemorial custom, and also greatly endanger the public health in the neighborhood of said Greenville creek in said county; and they hereby respectfully petition your Honorable Board to change the plans and require such sewage to be otherwise deposited or else purified before deposited in said creek.

The matter being referred to the Board, it was voted not to rescind its former action approving plans upon conditions noted above. The petitioners were notified, however, that if after the installation of the sewerage system at Greenville a nuisance should be created, steps would be taken by the Board to have purification works established without delay.

REPORT ON SEWAGE DISPOSAL FOR NORTH SEWER DISTRICT OF KENTON.

The city of Kenton, through its engineer, presented plans for a sewage disposal plant designed for the North Sewer District of that city by the City Wastes Disposal Company of New York.

The following is a description of the plant, as submitted by Mr. G. Everett Hill, Vice-President of the Company:

The district served is a small section in the northern part of the city, lying on a separate watershed, so that the sewage cannot be economically taken into the general system of the city. The sewage will consist entirely of domestic wastes; and the volume, for some time to come will not exceed 20,000 gallons per day. The plant proposed will treat 50,000 gallons per day.

The disposal works are located in the lower rear end of a farm a short distance outside of the corporation limits. The effluent is to flow into the county ditch, which traverses an open farming country for a distance of six miles before discharging into running water. No use is made of the water in this ditch in any part of its course.

Circumstances make it necessary that the plant occupy the least possible area; that it be low in first cost; and that its operating expense be but normal. To meet these conditions, we have designed along the lines indicated, in preference to using any other accepted system of treatment. It is obvious that complete purification—to drinking water standard—is unnecessary, for the present at least, and there is no reason why the community should be burdened with a more expensive plant. All the suspended solids of the sewage will be withheld and destroyed, and the effluent will be clear, colorless and odorless. Nitrification, while not complete, will be well begun, and the escaping water will contain a large amount of dissolved oxygen,—sufficient to make impossible any reversion to putrefaction, even although stored undiluted.

Briefly stated, the design and operation of the plant is as follows:

The solids are withheld and liquefied in a septic tank, of a size which will hold ten hours' average flow when the total daily discharge is 50,000 gallons.

To obviate detention of the sewage for an extensive period while the flow is small, our tank is divided into two compartments, independently controlled. One of these will suffice for early needs.

The overflow is collected by a carrier, of construction peculiarly adapted to minimize velocity and to avoid the escape of comminuted solids.

The bacterial change in this tank being anaerobic and putrefactive in its tendency, its effluent, of course, is foul and devoid of oxygen. Unless it can be discharged immediately into a large stream whose contamination is allowable, further treatment is necessary. The putrefactive drift must be stopped and offensive conditions eliminated; and oxidizing processes of aerobic purification must be inaugurated. This change can be effected only by thorough aeration.

The simplest way to accomplish this is by applying the septic tank effluent intermittently to beds of natural soil, of suitable porosity and well drained; but in practice this is often found unsatisfactory, and some-

times (as in the present case) impracticable. It is a practice which requires careful and judicious control, and which, in spite of the best of supervision, is sometimes objectionable, even when used for the treatment of fresh sewage. The period between the subsidence of the applied liquid and the drying of the surface scum and slime is always trying; and, when wet weather prolongs this period for a day or more, some offensive odor is almost sure to result. The writer has had soul-satisfying experience on this subject. The danger of annoyance is much greater when the applied liquid is already putrid, or is under the influence of putrefactive agencies, as is the effluent from a septic tank.

We have found that the aerating processes are usually more easily controlled and the desired results more surely accomplished by the treatment of the liquid in a medium of great porosity, artificially prepared, automatically controlled, and not influenced to any considerable extent by meteorological variations. We have provided coke filter beds to accomplish the aeration of the effluent from the septic tank proposed for Kenton.

Each bed is fed, intermittently, by a flushing filter, discharged by an automatic siphon whenever the liquid in the chamber rises to a certain height. The flow from the tank to each flushing filter is controlled by an adjustable spill-thimble. The chamber is filled with coke, surfaced with broken stone, to a height several inches above the discharging level, so that its contents are never exposed to direct sunlight. In action, these flushing filters are small "Dibdin beds."

The lower filter bed, or "apron" is a broad inclined surface (30x100 feet), lightly faced with concrete, and divided by light walls into channels corresponding to the filters. Across the lower end of the "apron" is a foot-wall, with openings under it for the discharge of the effluent into the outfall gutter. The apron carries a bed of pea coke, 18 inches deep at the upper end and 4 inches deep at the lower end. This coke is faced at the upper end and surfaced throughout with broken stone, to hold the coke in place, to exclude sunlight, and to assist in retaining the heat in cold weather. Next to the foot-wall is a thick bank of finer material—coke breeze or coarse sand, through which the effluent passes before its final escape. At the upper end of the apron, the bank of stone is shaped so as to form a "head-bay," into which the siphon discharges.

The operation of the apron is very simple. The siphon is proportioned to discharge the flushing filter much more rapidly than the apron bed will receive the flow, thus building up quickly a pressure head in the head-bay, whereby the upper end of the bed is charged at once to its full depth. As a result, a wave of sewage is started at the head of the apron in a body of porous material, and traverses the apron throughout its length (100 feet). This wave declines in vertical amplitude in its progress through the bed until it is arrested against the bank of the fine material at the foot, when it piles up again to nearly its original

height, and filters away at a relatively slower rate. The effective result is that the sewage passes through 100 feet of filtering material; and that every vertical transverse section of the bed is subjected to an intermittent rise and fall of sewage at short intervals, thus providing frequent aeration alternating with frequent application — an ideal condition. The passage of all the waves being similar in time and character, the bacterial colonies are accurately self-stratified, a condition which the experiments of Scott Moncrief and Colonel Waring have shown to be of great importance. It should be noted that the sewage never appears upon the surface until it escapes into the effluent outfall — a finished product.

A notable feature of the wave action through the retarding material of the bed is the charging of the effluent with oxygen, practically to the point of saturation. The volume and interval of the waves are so proportioned that, while two waves may be within the body of the apron at one time, any given section of the apron is nevertheless fully drained in the interval.

In the winter the flushing filters are protected by light wooden covers, and the apron itself is bedded in marsh hay, or any similar available material, to be raked off in the spring.

The system has just been approved by the New Jersey State Sewerage Commission, for use at Collingswood, N. J.

These plans were approved by the State Board of Health as presented, subject to any change the Board might see fit to require after a fair trial of the plant., and due notice of this action was sent to the City Engineer of Kenton, June 18, 1900.

REPORT ON SEWERAGE AND SEWAGE DISPOSAL FOR LAKEWOOD.

At a meeting of the State Board of Health, held in Cleveland, August 16th, 1899, certain plans for sewerage the hamlet of Lakewood were informally presented to the Board with the understanding that the matter should be brought before the Board definitely and in writing at a later date. The Board, however, felt that it would only be proper that the authorities and citizens of Lakewood should understand the attitude of the Board in reference to any proposition looking towards putting crude sewage into the lake. The sense of the Board in reference to this matter is given in the following resolution, adopted at the meeting above referred to:

Resolved, That this Board is not willing to approve any plan of sewage disposal which contemplates the discharge of crude sewage into Lake Erie or the Cuyahoga river at any point within ten miles of the city's intake of drinking water.

Later certain plans for a sewerage system for Lakewood were submitted to the Board. These were not satisfactory and this led to the following communication being sent to the trustees of the hamlet:

The State Board of Health has considered your application for approval of plans for a system of sewerage for the hamlet of Lakewood. The plans have not been approved, as the Board wishes more definite information regarding your plans for purification of the sewage. The action of the Board at its Cleveland meeting was to the effect that it would not approve of any plan for the sewerage of Lakewood which contemplates the turning of raw sewage into the lake, even temporarily. The Board wishes, therefore, to have complete plans and specifications for a purification plant, and will then be prepared to act upon your application for the approval of a sewerage system, including purification of the sewage.

Plans for a system of sewerage and sewage disposal were prepared by Messrs. Snow and Barbour, engineers, and presented to the Board April 18, 1900. The Board approved these plans and notice was sent to the trustees of the hamlet April 30, 1900.

Following is an abstract giving the essential features of the proposed plans:

The hamlet of Lakewood is beautifully situated on the shores of Lake Erie, about five miles west of the city of Cleveland. The terrace upon which it is built rises precipitously sixty feet at the lake shore, and slopes from the top of the bluff southerly, reaching a total elevation of 180 feet above the lake at the southerly boundary of the hamlet. The contour lines are usually parallel with the lake shore, and the natural system of drainage — at right angles with the contours — is accordingly northward to the lake.

The prevailing winds are westerly, and this fact, in view of the rapidly increasing smoke nuisance in Cleveland, and also because of the extremely attractive situation of Lakewood, will inevitably make the hamlet a most desirable residential location for the wealthier classes. Already preparations on a scale anticipatory of this development are being made, and there can be no doubt that within a few years Lakewood will have an assured position as one of the finest suburbs of the wealthy and rapidly growing city of Cleveland.

The division of the land will naturally be into large estates, the homes of the finest classes, and the property along the lake front the most desirable portion of the hamlet. Its value, and in fact, the future prosperity of the community as a residential district depends upon a jealous conservation of the lake shore, and it is accordingly apparent that the natural drainage of the hamlet into the lake cannot be directly taken advantage of in the case of its sewage.

The topography of Lakewood, as already described, is a plain sloping from the top of a bluff at the lake. This slope, while smooth and regular, does not follow exactly the same gradient, being steeper in the portion of the hamlet south of Detroit street. The result of this conformation is that surface water rapidly finds its way to Detroit street during storms,

where it ponds, to the serious detriment of the principal thoroughfare of the hamlet.

The only artificial surface drainage at present provided is through the combined sewers. These sewers are usually in the streets running north and south; the pipes south of Detroit street emptying into the small brooks near Detroit street, and those north extending to or near the lake. No elaborate system of interception has been attempted.

The present sewers have been constructed on both the separate and the combined system. Wyandotte and Belle avenues are the only streets controlled by the hamlet which are sewered on the separate system, the first emptying into the small brook just north of Detroit street, and the other into a brook near the new boulevard. The streets in the allotment of the Clifton Park Association are all sewered on the separate plan.

All other sewers are on the combined system.

The impossibility of dumping raw sewage along the shore of the lake is too apparent to merit discussion. Some method of purification is necessary.

The location of the disposal works is a problem justifying most careful study. There is no beach of sufficient width to afford an opportunity of building a plant at or near the lake level. If on the lake front, it must be constructed on the top of the bluff in the midst of the most valuable property—a project altogether infeasible from the standpoint of the owners of the territory. It is evident that the works should be placed in some section less intimately connected with the future growth of the hamlet along the lines upon which its prosperity will depend.

The western boundary of Lakewood is formed by Rocky river, which enters the lake between high bluffs, with here and there inter-valle lands of an extent sufficient for the location of disposal works. A flowing stream has advantages over a lake as a means of dilution; the constant incession of water moving onward and away from the disposal works precludes the necessity of a consideration of local currents.

The valley of Rocky river, from the standpoint of future growth of the hamlet, is eminently fitted for the location of a purification plant. The stream has a watershed of almost one hundred square miles in area—sufficient to guarantee at all times a considerable volume of water flowing to the lake, and one able, during a large portion of the year, to complete the purification of the septic effluent by oxidation.

For sewage purification the combination of septic tank and back-flooded bacteria beds is recommended for Lakewood.

The necessity of estimating future population and the economy of designing for the future depends upon the nature of the structure under consideration. At Lakewood, with the exception of the Boulevard interceptor, future requirements do not intimately affect the design. The grades available for the lateral sewers are generally sufficient to meet the maximum ultimate requirements with pipes of small diameters and such as would be laid for immediate use, regardless of future necessities.

The disposal works are of a class of construction which can be economically extended at any time in the future, and such as will not warrant a large expenditure of money in anticipation of future growth.

The only portion of the works in the design of which a consideration of future necessities is justified is the intercepting sewer. In this connection it has been estimated that the increase of population in Lakewood will take place at the rate of one thousand population per year, reaching a population of twenty-three thousand in 1920. The interceptor is of sufficient size to take care of the sewage of such a population.

Summing up this phase of the problem, it may be said that the lateral sewers are sufficient for all time, and the interceptor for twenty years; the disposal plant, being easily capable of economical extension at any time in the future, is based on a shorter period.

The works proposed for Lakewood include a separate system of sewers thoroughly underdrained; an interceptor through which all sewage both from the new sewers and from all separate sewers now laid will be conveyed westerly to the valley of Rocky river; a cast-iron siphon laid in the valley of this stream and extending to the disposal works, located on inter-vale land on the west shore of the stream; and a purification plant consisting of septic tank and bacteria beds.

As already described, the topography of Lakewood is such that surface water in large quantities rapidly reaches the principal thoroughfare of the hamlet — Detroit street — in time of storms, and owing to inadequate drainage ponds at that point, causing much trouble. The system of surface pipes proposed for present installation are designed to relieve this trouble.

The necessary capacity of surface drains depends upon the rainfall, the topography of the surface drained, and the state of development of the territory. The percentage of impervious area increases with the population, and the necessary size of drains is accordingly in some degree a function of the population. Future growth and development must therefore be taken into account in preparing the design. It is difficult in any case to forecast the future necessities of surface drainage, and the pipes proposed for present installation are not designed for ultimate requirements but are proposed for the relief of the present condition of Detroit street. When this street is resurfaced and improved a drainage system adequate for all time can be installed.

In our calculations of ultimate run-off the rational formulæ of Mr. Parmalee of Cleveland, have been used. The steepness of the slope renders the time of concentration of flood waters very short and the rate of rainfall inversely high; this factor reaching in many cases four inches per hour. These conditions will result (when the territory shall have been fully developed) in a necessity for pipes of larger diameter. An attempt to meet ultimate requirements is impossible under the present bond issue, and, as already stated, it is now proposed to take advantage at this time

of the economy of placing in the same trenches with the sewers pipes sufficiently large to afford relief for sometime in the future. A comparison of the capacity of the proposed pipes shows them to be capable of handling about one-third of the flood discharge which will ultimately concentrate at the point of installation should Lakewood ever have a population of thirty people per acre, with all streets paved and house lots averaging six in number to the acre.

The proposed surface drainage is confined to Detroit street, and is laid in three sections, the most easterly being between Highland and Nicholson avenues, the intermediate extending a short distance east and west of Elmwood brook, and the westerly from Wagar avenue to Boulevard South, and thence through this street to the brook.

The proposed system of sewers, generally speaking, consists of laterals running north and south, intercepted by the sewer in Detroit street and finally by a main interceptor laid in the new Boulevard. It is planned to utilize the present combined sewer in Cranford street by cutting off the catch basins.

All laterals have been given grades to guarantee self-cleansing velocities. Manholes have been planned for all changes of line and grade, and at intermediate points, where the distances exceed four hundred feet. These chambers are to be provided with perforated covers for ventilation. In all paved highways two sewers have been planned, the pipes being laid on the side of the street; the cost of two sewers being less than a single sewer with long house connections, when this latter construction necessitates the tearing up of improved pavements. In all other cases the sewers are designed to be laid in the center of the streets.

Under all sewers it is proposed to place underdrains laid with open joints in coarse cinders. This construction will make possible good work and tight joints in the laying of the separate sewers, and greatly reduce the amount of ground water which will find its way to the disposal works. As a further justification of these underdrains, it is proposed to lay the house connections in cinders, in this way making possible cellar drainage — a valuable improvement in the case of Lakewood, with its retentive subsoil — and one calculated to add materially to the hygienic well-being of the community. The underdrains are discharged at the first opportunity where grades will permit entrance into the brooks.

Instead of laying a sewer in the improved Lake avenue, it is proposed to place a pipe on the back lot line between the Boulevard and this territory, which will serve the residents on the south side of the avenue and the north side of the Boulevard.

The sewers proposed for construction under the present bond issue are the Boulevard interceptor, Detroit street, Cove street, Nicholson street, Hird street, Boulevard South, Warren road and Winchester avenue.

The estimated cost of these sewers, exclusive of the interceptor and including the surface drainage of Detroit street is \$53,000.

The intercepting sewer is to be placed on the south side of the Boulevard. Starting at Highland avenue, this sewer increases from 12 inches in diameter by increments depending upon the amount of territory intercepted, to a 24-inch pipe at Cranford street, the prevailing grade being about one foot in 600 feet. Reaching the westerly terminus of the Boulevard the interceptor follows the back line of the lots fronting on Lake avenue and Clifton road, and thence across country to a siphon chamber at the edge of the steep bluff on the east side of Rocky river. The use of this back land for the location of the sewer line is at the request of the Clifton Park Association, which prefers that the streets which are macadamized and already piped with water, gas, sewers, and surface drains, should not be dug up. From the standpoint of the hamlet it is a favorable course, as it considerably shortens the length of the interceptor.

The estimated cost of the intercepting sewer is \$54,700.

The design of an inverted siphon depends both upon the present minimum and the future flow of sewage. It is necessary that the velocity shall not be too low to insure the maintenance of a clean pipe with the small flow which may naturally be expected in the early years of the system. Future growth of the hamlet and extension of the sewers will necessitate a conduit of considerable dimensions, such as would reduce the present velocity below a feasible limit. The evident solution of the problem is to divide the outfall into a number of small conduits.

The large number of outlets where sewage is discharged at present has made impossible any measurement of the present flow of sewage, and we have had to content ourselves with an estimate based on general premises. It is believed that with the extensions contemplated under the bond issue the flow which may be expected at the beginning of operations of the disposal works may be placed at 300,000 gallons; should it fall short of this amount the deficiency can be made up by turning under-drain water into the sewers—a precaution which will not only insure a self-cleansing velocity in the siphon, but will also serve for flushing purposes.

On this basis it is proposed to lay a 10-inch cast iron pipe from the end of the intercepting sewer to the disposal works. At both ends short lengths of 16-inch pipe will be laid through the masonry in anticipation of future construction (as may be necessary by the growth of the hamlet). This pipe, with the 10-inch proposed for present construction, will afford a siphon capacity approximately equal to that of the intake, or sufficient to carry the sewage of the estimated growth of Lakewood twenty years hence.

At the inlet chamber the 16-inch pipe is blocked off by a wall of brick, so that all sewage will smoothly enter the 10-inch pipe. In this chamber an intercepting or precautionary wall is to be placed. This will consist of three rows of 4-inch pipe placed nine inches on centers and surrounded

by concrete. This wall is designed to prevent the passage of anything carelessly thrown into the sewer, large enough to interfere with the action of the siphon. It is believed to be better than a screen, as it will intercept more efficiently long sticks and similar articles which might pass through a barred screen, while at the same time it will not tend to prevent the passage of other matters.

The grade and alignment of the siphon have been most carefully considered. The entire drop below hydraulic gradient is made rapidly to the point of blow-off, to facilitate the retreat of any gases against the advancing current. The blow-off is equipped with gates and a side chamber from which the sewage can be pumped so as to empty the portion of the siphon which is below water level in the river. From the blow-off, a rising grade extends to the septic tanks, the pipe passing under Rocky river in a trench surrounded by concrete. The alignment is by long easy curves, and follows the foot of the bluff.

The estimated cost of the siphon is \$10,735.

The septic tank is a covered masonry reservoir built entirely of concrete except the brick piers. To reduce the cost of centering, and at the same time to obtain the advantage of a groined arch roof, it is proposed to cover the reservoir with a flat roof of steel-concrete construction, reinforced by concrete arches or beams on the lines of the piers. In this way simple circular centers can be used for the arches and the concrete covering laid on flat centers. The only thrust transmitted to the walls will be on the lines of the arches, and to offset this thrust the walls will be enlarged by buttresses opposite the center lines of the piers. The total capacity of the tank—300,000 gallons—is divided into two units of 150,000 gallons each.

Although the general practice has been to base the design of septic tanks upon an exposure of the sewage to the action of the anaerobic bacteria for twenty-four hours, experiments have shown that the optimum period cannot be considered as fully determined. It is believed that there may be but little difference between a twelve and a twenty-four hour exposure, and the tank proposed for Lakewood is assumed to have a capacity of 600,000 gallons. Such an assumption implies no risk, as the flow of sewage in the first years of operation will not exceed 300,000 gallons, or the capacity of the tank on a twenty-four hour basis of septic treatment. The possibility of economically increasing the capacity by the construction of additional units at any time fully justifies the acceptance of the present design.

The desirability of a regular rate of flow through the tanks has been recognized, and an automatic orifice has been designed which by making possible a rise and fall of the sewage in the tank of nine inches, while maintaining a uniform discharge, will serve to neutralize the hourly variation in rate of flow.

The sewage enters at three points in each unit, in order to obtain as nearly as possible a uniform velocity throughout the entire cross-section.

tion. The effluent leaves the tanks through a slotted pipe bracketted to the wall at a depth of two feet below the water line. From this pipe it is carried to an outside chamber extending across the entire width of each unit, where it is subjected to supplementary sedimentation. From this chamber it passes through an automatic orifice at a considerable velocity, and in such a way as to thoroughly free the liquid from the gases resulting from the anaerobic treatment.

Each of these orifice chambers is provided with an inlet air pipe carried to the surface of the surrounding embankment, and an outlet or ventilating pipe which rises ten feet above the surface.

After being sprayed and freed from its gases, the effluent flows to an aerating chamber where it runs over a slope provided with riffs, and is thoroughly exposed to the atmosphere. In this way it is believed that the amount of dissolved oxygen will be effectively increased and the effluent further prepared for the aerobic action upon which its final purification in the bacterial beds depends.

The inlets and outlets to the septic tank are trapped, and the tank is practically air tight, although manholes permitting entrance into each section will be provided. A drain which passes through the bottom of the aerating chamber makes possible the emptying of any single tank to elevation 16 onto the beds, and of the entire tank by pumping the remaining four feet into the first section of the aerating chamber, from which it will flow to the beds by gravity. Provision is also made for by-passing raw sewage directly to the beds without septic treatment.

The first section of the aerating chamber contains two gates which permit the sewage to be turned either to the beds proposed for present use, or to those which will be built in the future. In the design of the septic tank and the system of handling the sewage and effluent, an endeavor has been made to carefully separate the anaerobic and aerobic treatments to as great an extent as possible. Experience has proved this to be essential to success, and it is believed that the plans proposed will accomplish this in a most effective manner.

The estimated cost of the septic tank is \$6,775.

The bacteria beds proposed for present construction are circular in plan, have a total area of five-eighths of an acre, and are divided into five sections.

Bacteria beds, as already stated, are structures in which, under the conditions most favorable to their existence, the organisms upon which the purification of sewage depends can grow and multiply. These conditions imply the presence of dissolved oxygen, and the entrance of air through the entire depth of the bed, between the doses of sewage. To make this possible, the material must be coarse enough to reduce capillarity to a minimum, and at the same time fine enough to intercept the comminuted particles of the organic matter. The limit of sizes of bed material, as shown by experience, is from one-sixteenth inch to one-half inch, expressed in diameter of extreme particles.

From a personal examination of all the large furnaces in the vicinity of Cleveland, supplemented by chemical and mechanical analyses, it has been concluded that the cinders, which are produced in enormous quantities, will after the removal of the dust by screening and the reduction of the larger particles by crushing, be a valuable material for use in back-flooded beds. The city of Cleveland is a most favorable locality for the obtaining of such material, and it is proposed to institute a system of collection, shift the cars to a siding on a trestle near the Detroit street bridge, and there to crush and screen the cinders, hauling the material from this point to the disposal works.

The operation of the beds will be automatically governed, and no attendance other than that required by any similar piece of mechanism will be necessary in the handling of the sewage.

Four beds will be in commission at a time, the fifth being thrown out for periods of rest of a week or more. Of the four in use, one will be filling, one standing full, one emptying and one resting and the automatic mechanism will not only effect this distribution of the several factors in the process of purification among the four sections at a great saving in cost of labor, but with a regularity impossible of attainment by any other means.

The carriers will be constructed of concrete with plank sides, the width being reduced at each outlet to the sub-carriers in such a way that the uniform depth will be maintained throughout. Sub-carriers will be made of one-half or channel pipe.

The underdrains will be of vitrified pipe with open joints, the upper surface of the pipe being at the bottom of the bed material, the pipes being placed in the hollows of waves into which the foundation will be graded. These drains will be surrounded by the coarser portions of the cinders. Provision will be made so that the drains can be back-flooded and remain full at all times, if this is found desirable, in order to prevent a possible turbidity in the first rush of the effluent. The underdrains will be comparatively few in number, and the effluent will flow laterally through a layer of coarse material, the object being to insure that all sewage will come in contact with the bed material and not directly enter the underdrain pipes without being sufficiently subjected to the purifying action of the bacteria.

The main underdrain will enter the back-flooding chamber into which will also enter the pipe from the aerating chamber, through which septic effluent can be discharged directly to the stream in time of high water. In this back-flooding chamber a wall with its top at elevation 10.5 will prevent back-flooding of the beds. From this chamber a 12-inch pipe will be laid to the river. The surface of the beds is at elevation 15, the bottom of the beds at elevation 26, the known flood limit at the site of the filters and the disposal works is at elevation 9, and the stop wall in the back-flooding chamber will, as already stated, prevent the flooding of the bed material.

The estimated cost of the bacteria beds and distribution system is \$17,400.

The estimated cost of the land which it is believed advisable to take for the disposal plant, in view of future extensions, is \$2,500.

It may be well to briefly describe the course of the sewage when undergoing purification, and to emphasize the fact that the operation of the entire plant is practically automatic.

The sewage entering the chamber at the lower end of the siphon will flow along the west side of the septic tanks, where it will enter the units which are in operation. Coming practically to a rest in the tanks, the solids will be deposited and liquefied, the effluent issuing from twelve to twenty-four hours later, the time of septic exposure depending upon the sewage reaching the tank. After leaving the tanks the effluent will pass through the orifice chamber, where it will be sprayed and the freed gases carried off through the ventilating pipe; thence to the aerating chamber, where it will be exposed to the air, and thence onto the automatic apparatus which will distribute it to the several beds in proper routine and at the same time govern the discharge of the effluent.

In case of accident to the septic tanks the raw sewage can be bypassed directly to the beds, and in times of high water the septic effluent can be discharged directly into the river. These changes in the ordinary routine and such work on the surface of the beds as may be necessary is all the labor required in the handling of the sewage.

The total estimated cost is as follows:

Lateral sewers	\$ 53,000
Intercepting sewers	54,700
Inverted siphon	10,735
Septic tanks	6,775
Bacteria beds	17,400
Land ..	2,500
Total ..	<u>\$ 145,110</u>

REPORT OF ADDITIONAL SEWERAGE FOR LIMA.

At a meeting of the State Board of Health, held May 8th, 1900, a Committee on Sewerage of Lima and the City Solicitor of said city, appeared before the Board and asked approval of plans for the construction of certain proposed sewers, to-wit: The Timberlake trunk sewer, the Watt Town trunk sewer and the Askins trunk sewer. A map showing the location of these sewers and specifications for their construction were filed with the Board.

These plans were approved upon the condition that all sewage now being, or to hereafter be discharged into the Ottawa river should be purified in a manner satisfactory to the State Board of Health before

the proposed sewers were brought into use; and notice of approval was sent to the Committee of Council May 10, 1900.

As supplementary to the notice of approval the following communication was sent to the Mayor and Council of Lima:

Notification has been sent to the Committee that waited upon the State Board of Health recently in regard to the approval of plans for additional sewers for your city, of the action that was taken at that time. The Board is of the opinion that no additional sewage should be permitted to be turned into the Ottawa river. The new sewers that you are proposing to build were approved, therefore, only upon the condition that before they are put into use works for the purification of the sewage, satisfactory to the State Board of Health, shall be established. The plans for such purification works will have to be submitted to and receive the approval of the State Board of Health, and I would respectfully suggest that some action be taken by your body now to locate and plan such works so that they may be constructed by the time you have completed the proposed additions to your sewerage system.

REPORT ON SEWAGE AND GARBAGE DISPOSAL FOR MANSFIELD.

The council of the city of Mansfield presented plans for extending the sewerage system of that city and for a sewage disposal plant which they asked the Board to approve. Following are the essential features of the plans, which were prepared by Messrs Snow and Barbour, Consulting Engineers:

Mansfield is situated near the head waters of the Rocky Fork of the Mohican river. The city is located on the west side of this stream, on high ground, and is intersected by the rather deep valleys of Ritter's and Touby's runs.

The population of Mansfield, as given by the Census reports for the last forty years is as follows:

1850	3,558
1860	4,581
1870	8,029
1880	9,589
1890	13,473

The population estimated for 1900, in the report of the State Board of Health, on Public Water Supplies, was 18,410; if calculated on the same basis of persons to a dwelling as was found existing in 1890, the population at present would be 20,880.

The facilities for natural drainage, as already indicated in describing the topography of Mansfield, are excellent. Surface water has but a short distance to flow before it reaches either Ritter's or Touby's run.

The first named stream is already arched over in a number of places, and is gradually being turned into a large sewer.

The sewerage of Mansfield, as thus far developed, is on the combined system. It is designed to carry both the surface water and the sewage. The design of the pipe system is accordingly based on the storm discharge, and the sewers vary from 8-inch circular vitrified pipe to 3.73x4.73 feet brick conduit. About nine miles of sewers have been laid; the principal outlet of the system being into the Rocky Fork, on an extension of John street. Through this outlet the sewage from the greater portion of the business district of the city, and a small part of the residential, finds its way to the stream.

The sewered area is known as Assessment District No. 3, and the sewers are paid for by property owners in this district. There has been *absolutely* no assessment on any property outside of this district for sewer purposes.

To ascertain the quantity of the dry weather flow of sewage, a weir was constructed at the mouth of the John street sewer, and measurements taken for a week. The following table shows the results of these gagings and the percentage of the flow which each hour was of the total 24-hour discharge.

Hour.	Gallons per hour.	Per cent. of 24 hours flow.	Hour.	Gallons per hour.	Per cent. of 24 hours flow.
1 a. m.....	30,400	4.00	1 p. m.....	31,800	4.15
2 a. m.....	27,000	3.50	2 p. m.....	35,000	4.60
3 a. m.....	27,000	3.50	3 p. m.....	35,900	4.65
4 a. m.....	27,300	3.50	4 p. m.....	35,000	4.60
5 a. m.....	25,600	3.25	5 p. m.....	33,200	4.40
6 a. m.....	27,000	3.50	6 p. m.....	32,600	4.35
7 a. m.....	28,500	3.75	7 p. m.....	32,600	4.35
8 a. m.....	34,000	4.45	8 p. m.....	31,800	4.15
9 a. m.....	36,600	4.80	9 p. m.....	31,300	4.15
10 a. m.....	38,500	5.05	10 p. m.....	31,800	4.15
11 a. m.....	37,000	4.75	11 p. m.....	30,400	4.00
12 m.....	35,900	4.70	12 p. m.....	28,800	3.75

Total for 24 hours—765,000 gallons.

The slight hourly variation, which is much less than would result from a normal flow of city sewage, shows the effect of the springs which are now flowing into this sewer, and which it is claimed can be removed.

There are about 2,300 families on the line of the sewer, and it is estimated that the sewage of about 8,000 people finds its outlet through the system now constructed. Probably by cutting out the springs, the actual flow of sewage can be reduced to less than 500,000 gallons, or a rate of about 75 gallons per capita of people provided with sewers.

From a qualitative standpoint there is nothing distinctive about the sewage of Mansfield. The manufactural interests are such as do not have any large liquid wastes.

The conditions resulting from the emptying of sewage, into any stream are dependent not only upon the amount of sewage, but upon the size of the stream and its ability to dilute the sewage beyond the point of nuisance. The watershed of the Rocky Fork at a point just below the junction of Ritter's run with the main stream has been found to have an area of 30.2 square miles. The average slope of this stream is about 1 in 1500 feet; the valley is flat for a considerable distance back from the stream course, and surrounded by hills with pronounced slopes. Springs are common in this valley, and the dry weather flow is considerably larger than what might otherwise be expected.

As an approximate indication of the run-off of the Rocky Fork, it is believed that the rainfall records and per cent. of runoff obtained from gagings of the Muskingum river will be of value.

On this basis the following table shows the runoff for twelve years of the Rocky Fork, in total cubic feet per second:

TABLE SHOWING RUNOFF OF ROCKY FORK, IN TOTAL FEET PER SECOND.

Year.	January.	February.	March.	April.	May.	June.	July.	August.	September.	October.	November.	December.
1887	9.03	88.50	80.25	23.90	8.50	7.70	2.92	1.06	2.66	0.80	1.33	2.92
1888	12.75	29.23	9.83	17.52	7.95	7.43	19.75	7.95	19.75	21.00	41.15	23.90
1889	44.00	9.03	20.70	34.00	11.67	13.29	2.92	34.00	34.00	26.12	14.32	43.85
1890	76.50	77.85	104.85	46.80	115.50	23.55	11.67	5.58	19.90	14.78	50.50	24.18
1891	57.60	95.85	76.50	31.60	13.00	9.84	9.30	6.90	6.36	5.29	12.50	11.08
1892	13.29	47.00	26.80	17.52	57.30	21.22	6.10	19.75	6.14	5.04	5.85	4.25
1893	6.10	103.50	70.60	44.15	126.50	8.50	5.04	5.04	4.51	8.50	3.43	26.12
1894	20.40	56.50	42.75	39.00	13.55	13.00	7.42	3.19	59.50	3.19	4.25	9.83
1895	32.10	6.29	29.23	7.15	1.86	10.10	3.43	1.59	2.66	1.26	3.72	9.03
1896	15.40	66.90	19.10	44.15	7.43	14.08	17.52	4.78	36.35	1.33	6.36	28.40
1897	7.15	34.90	37.95	35.60	14.60	5.58	23.90	19.75	6.90	0.53	25.77	29.23
1898	44.90	33.20	73.40	27.39	21.20	9.55	15.90	14.08	13.29	40.76	19.20	26.60
Average	28.34	51.07	49.33	30.73	23.30	11.99	10.49	7.71	17.68	10.66	15.45	20.19

The following is an abstract of the preceding table, showing the minimum runoff for different periods:

Period.	Cubic feet per square mile.	Total cubic feet.	Gallons per 24 hours.
Dryest 1 month, August, 1887.....	.023	.695	449,000
Dryest 2 months, July and August, 1887.....	.045	1.36	879,000
Dryest 3 months, August to October, 1887....	.065	1.96	1,260,000
Dryest 6 months, July to December, 1887....	.083	2.50	1,615,000
Dryest 1 year, 1895.....	.331	10.00	6,462,000

A weir was built on the Rocky Fork below the junction of Ritter's run with the main stream, and gagings were taken during August and September. The average flow in August was about 5.00 cubic feet per second; in September it ranged from 5.00 to 45.00 cubic feet per second.

These flows are not indicative of possible minimum, and the figures in the preceding table and abstract are a better basis on which to estimate possible dilution.

Sanitarians have agreed that in order to dilute sewage beyond the possibility of a nuisance, a flow of from 2.5 to 7.0 cubic feet per second per 1,000 people contributing sewage to the stream must be available. Assuming as an average 4.0 cubic feet per second, and adopting the analyses of normal sewage, as given by Mr. F. P. Stearns, when Chief Engineer of the State Board of Health of Massachusetts, the analysis of a stream just within bounds of permissible pollution would be as follows in parts per 100,000:

Free ammonia.	Albuminoid ammonia.	Dissolved solids.	Chlorine.
.0796	.0139	1.01	.19

The following figures show the results of analyses made of the water of the Rocky Fork on May 4th and June 6th, 1899 by the State Board of Health:

	May 4th.		June 6th.	
	Above town.	Below town.	Above town.	Below town.
	Parts per 100,000.		Parts per 100,000.	
Odor	none	foul	earthy	foul
Oxygen cons.....	2.42	5.81	29.80	39.94
Nitrogen as free amm.....	0.0081	0.0708	0.0044	0.0128
Nitrogen as alb. amm.....	0.0170	0.0372	0.0432	0.0636
Chlorine	1.30	14.4	2.8	10.90
Bacteria	775	73,870	5,710	439,600

It is evident from the above table that the Rocky Fork above Mansfield contains but little pollution. The entire population on the watershed is about 3,000, or 100 per square mile, and the effect of this number of people upon the quality of the water is not sufficient to reduce its ability to dilute the sewage.

The results obtained from the analyses of May 4th are of more value than those of June 6th, because of the fact that on the latter date

the stream was in flood flow. Comparing the figures of May 4th with those given in the above standard of permissible pollution, it will be seen that even on that date the resulting mixture of sewage and stream flow would be liable to cause a nuisance, although it is evident from the analyses that the stream flow amounted to several times the quantity flowing in dry periods.

These figures are not presented here to prove theoretically the existence of a nuisance in the valley of the Rocky Fork. There is sufficient sensual evidence of this fact to render any theoretical proof unnecessary, and our only reason for discussing this phase of the subject is to emphasize the fact that the conditions resulting from the discharge of sewage into a water course depends not only upon the relative quantity of the two liquids, but also upon their quality.

An examination of the table showing the runoff of Rocky Fork indicates the fact that for several months in the year a considerable portion of the raw sewage may, on the assumption of 4 cubic feet per 1,000 people, be safely discharged into the stream, or, which is an equivalent statement, that during a large part of the year it is not necessary to attain any high degree of purification of the Mansfield sewage. While this is true on the basis of an average, it is more evident from an examination of this table, and more particularly from a study of the digest of the runoff results, that during prolonged periods in dry years a high degree of purification must be reached in order to prevent a nuisance.

The practical result of this discussion is that works economically designed for Mansfield should be designed to treat all the sewage at all times, and that these works should be so designed as to correlate the degree of purification to the possible dilution in different seasons.

The digest of a minimum runoff makes it evident that a means of sewage disposal is urgently needed, and that not only must the sewage of one particular district of Mansfield be treated, but that purification is obligatory on the entire city.

In this connection, the following letter from the State Board of Health, under date of September 8th, 1899, is to the point.

"The State Board of Health considered your communication of August 16th, 1899, in reference to its position as regards permitting the city of Mansfield to discharge additional raw sewage into Rocky Fork creek. I beg leave to inform you that, at a meeting of the Board held August 16th, 1899, the Board voted that it would disapprove the discharging of additional raw sewage into Rocky Fork creek. * * * "

Legal suits have been instituted against the city for nuisance created by emptying the sewage into the Rocky Fork. It is evident from the above letter that the sanitary improvement of Mansfield must remain at a standstill until means are provided for the purification of the entire

sewage of the city, and not that alone from the third district, already sewered.

Summing up the study of present conditions, it appears that a portion of the town, known for sewer purposes as the "Third District," has, at its own expense, and without cost to property owners outside of this district, built sewers; that the sewage thus collected and discharged is at present creating a nuisance during a portion of the year, along the course of the Rocky Fork; that this nuisance is both sensually and theoretically apparent; that legal suits have resulted; and that improvement of the present conditions by some method of purification is inevitable. Furthermore, the State Board of Health has taken the position that not only must the sewage from the district already sewered be purified, but that no additional sewage from any other district can be discharged into the stream, thus making the matter of purification an undertaking that must be assumed by the entire city, and not by any one district.

A careful study of the possibilities of coarse back-flooded filters and septic tanks in connection with local conditions at Mansfield, has led us to recommend the use of septic tanks for preliminary treatment of sewage, and the filtration of the septic effluent through bacteria beds composed of slack or waste coal.

It is recommended that the disposal plant be located on the property of Mr. H. C. Hedges, south of the Wooster road and between the Rocky Fork and the Pennsylvania railroad. This location has all the features desirable in the site of a disposal works. It is close to a water course, making easy the discharging of the effluent; close to a railroad, facilitating the construction and maintenance of the plant; and close to the city, making the transportation of the sewage and garbage economical.

In every system of disposal certain sewers are necessary to convey the sewage from the city to the disposal works. These sewers are of common benefit to the entire community, irrespective of districts, and so are usually considered a part of the disposal works.

At Mansfield, as already stated, a gravity and a pumping system are advisable, and the main outfall of each system, up to the point where these conduits enter particular districts, have accordingly been deemed integral parts of the disposal works, and so assessable upon the entire city.

For the present, therefore, it is proposed to construct the low level sewer from the disposal works to the point where it intercepts the outlets of the sewers already constructed, at John street, and to also build a high level sewer from the disposal works to a point where it enters the fourth sewer district.

To convey the sewage from the high level district it is proposed to construct a siphon underneath the Pittsburg, Fort Wayne and Chicago division of the Pennsylvania railroad.

This siphon will be built of cast iron, an 8-inch pipe being laid at present, with a 12-inch along side of it in the section under the railroad and at the blow-off and terminal chamber.

The low level outfall ends in a pump well ten feet square, and constructed of concrete, from which it is proposed to lift the sewage by pumps to the septic tanks. The invert of the outfall sewer at its entrance to the well is at an elevation of 85.84. The bottom of the well is at an elevation 76.0 and its capacity below the mouth of the sewer slightly in excess of 6,000 gallons, or five minutes run of the pumps. Its depth is a sufficiently large proportion of the total pump lift to enable the rise and fall of the sewage in the well to act to a certain extent as a governor on the speed of the pumps, and to thus reduce the necessary attendance.

The sewage will pass through a screen of $\frac{3}{4}$ -inch wrought iron bars, spaced $1\frac{1}{4}$ -inch on centers, and designed to prevent the passage of anything liable to injure the pumps. Access to the screens will be gained through the tower which rises above the well to the level of the garbage dumping floor. This tower will contain an iron stairway, by which the attendant can descend to the screen level, and a counter-balanced screen box running in guides and making possible the rapid removal of the screenings to the crematory. No other entrance to the pump well except from the upper garbage floor will be provided—an arrangement intended to prevent the entrance of odor and obnoxious matters to the lower floor of the station.

The building which is to contain the pumps and boilers is also to hold the garbage crematories—its size and cost is more nearly dependent upon the latter than the former, and its description might reasonably be postponed to the discussion of the disposal of garbage. In order to make plain the arrangement of pumps and boilers, it will be shortly described at this point.

The building is in two parts, in one of which the pumps and engines can be placed, and in the other the boilers and garbage crematories.

The floor of the engine room has been placed at elevation 93, or 9.5 feet below the level of the ground outside. This was necessary in order to reduce the suction lift to a safe limit.

The boiler and crematory house has two floors. The upper will serve as the garbage dumping floor, and is entered from the ground surface, the lower is to be the firing room.

It is proposed to install two centrifugal pumps, each of a capacity of 2,000,000 gallons per twenty-four hours; these pumps to be directly connected to engines supplied with steam from two 25 H. P. boilers.

From the pumps a 12-inch force main will lead to the entrance gate chamber of the septic tanks.

The sewage from the high and low level district meets in the entrance chamber of the septic tanks, that from the high district flowing directly

to this chamber through the siphon, that from the low being lifted by the pumps from the low level outfall.

The septic tank is a large underground structure, built entirely of concrete, except the brick piers which support the groined arch roof. The total capacity of 1,000,000 gallons is divided into four units of 250,000 gallons each, in order to make possible the emptying and examination of the interior of any one unit.

Experience has indicated that an exposure of the sewage to the action of the anaerobic microbes for about twenty-four hours is the optimum period, and it is upon this basis that the tanks have been estimated to have a daily capacity of 1,000,000 gallons. There is little difference in the results of an 18-hour exposure, however, and the tanks will undoubtedly be able to handle one and one-third million gallons per day for an indefinite period, and at least four million gallons during short flood flows, although in the last case the action would be one of sedimentation rather than of liquefaction.

The desirability of a regular rate of flow through the tanks has been recognized, and the necessity of a reservoir to equalize or nullify the hourly variation has been considered. It has been concluded, however, that no independent tank is necessary, but that it is possible to so arrange the discharging apparatus of the septic tanks as to make these tanks act as an equalizing reservoir. To accomplish this it is proposed to use such an orifice that the discharge will not be much affected by a rise of several inches in the tank, and to thus make possible a slight increase of storage during the maximum day flow. The capacity of the six-inch space available between the normal and maximum water line is 72,000 gallons, and as weir measurements of the discharge of sewage at Mansfield show that a capacity of 36,500 gallons would equalize the hourly flow, it is evident that this small rise and fall in the septic tanks furnishes a storage amply sufficient to guarantee a uniform flow of sewage to the beds.

The sewage enters at four points in each unit, in order to obtain as nearly as possible a uniform velocity throughout the entire cross-section. The effluent leaves the tanks through a slotted pipe bracketted to the wall, at a depth of 2 feet below the water line, and from this pipe it is carried to an outside chamber extending across the entire length of each unit, where it is subjected to supplementary sedimentation. From this chamber it passes through the controlling orifice at a considerable velocity, and in such a way as to thoroughly free the liquid of the gases resulting from the anaerobic treatment. Connected with this outlet chamber and immediately opposite the point of discharge of the orifice are ventilating pipes which lead to the chimney of the garbage crematory. In this way all odors which might arise from the septic effluent will be rapidly carried off and harmlessly discharged from the top of the stack.

After being thus sprayed and freed from its gases, the effluent flows to an aerating chamber, where it falls over a series of steps and is thoroughly exposed to the atmosphere. In this way it is believed that the amount of dissolved oxygen will be effectually increased, and the effluent thoroughly prepared for the final aerobic action, upon which its purification in the bacteria beds depends.

The inlets and outlets to the septic tanks are trapped, and the tanks are practically air tight, although manholes permitting entrance into each section will be provided. A lower drain which passes through the bottom of the outlet and aerator chambers makes possible the emptying of any single tank on the beds; and provision is also made for by-passing raw sewage directly to the beds without septic treatment.

After passing the aerating chamber the effluent is carried to a gate chamber containing gates by which the sewage or septic effluent may be flowed to any of the three beds proposed for present or future construction, or directly to the river.

In the design of the septic tanks and system of handling the sewage and effluent, an endeavor has been made to carefully separate the anaerobic and aerobic treatments of the sewage. Experience has proved this essential to success, and it is believed that the plan proposed will meet this necessity in a most efficient and economical manner.

Each set of bacteria beds is circular in plan, has a total area of $1\frac{1}{4}$ acres, and is divided into five sections, each with an area of $\frac{1}{4}$ acre.

It is proposed to use as a medium for the bacterial action waste or slack coal. A personal inspection of the mines, made by us, has shown practically unlimited quantities of this material piled up, and in many cases in the way of the mine owners. Mechanical analyses have proved it to have an effective size varying from .12 to .30 mm, and a co-efficient of uniformity varying from 10.0 to 15.0, these figures depending upon the original qualities of the coal and the size of mesh of the finest screen through which it has been passed by the manufacturers.

The operation of the beds will be automatically governed, and no attendance other than that required by any similar piece of mechanism will be necessary in the handling of the sewage. Four beds will be in action at a time, the fifth being thrown out for periods of rest of a week or more. Of the four in use, one will be filling, one standing full, one emptying, and one resting, and the dosing mechanism will not only effect this distribution of the several factors in the process of purification among the four sections at a great saving in cost of labor, but with a regularity impossible of attainment by any other means.

The carriers will be constructed of concrete with plank sides, the width being reduced at each outlet to the sub-carriers in such a way that a uniform depth of flow will be maintained throughout. The sub-carriers will be made of one-half channel pipe.

The underdrains will be vitrified pipe laid with open joints, the upper surface of the pipe being at the level of the bottom of the bed.

Provision will be made so that these drains can be back-flooded and remain full at all times, if this is found desirable, in order to prevent possible turbidity of the first rush of the effluent. The underdrains will be few in number, and the effluent will flow laterally through a layer of coarse material, the object being to insure that all sewage will come in contact with the bed material and not directly enter the underdrain pipes without having been subjected to the purifying action of the bacteria. The main underdrain from each set of the beds will find an outlet to the river through the same pipe which is used to discharge septic effluent. The river end of this pipe will be provided with a balanced back-flooding gate.

Although not necessarily a part of the sewage disposal problem, the advantage of straightening and deepening the channel of the Rocky Fork has forced itself on our notice in considering other portions of the work.

The carrying capacity of any water course depends not only on its actual size, but also upon its alignment and section. The watershed of the Rocky Fork has an area, at the location of the disposal works, of 30.2 square miles. The present channel is particularly crooked and irregular in depth, and without greatly adding to its width its capacity can be considerably increased by straightening. In order, however, to make it capable of carrying the flood flows which periodically occur, it must be widened.

In estimating the flow of streams, rainfall records and percentages of runoff must be obtained. The size of storm for which it is economical to provide discharging capacity in the channel is a question of insurance, of comparing the probable damage from storms if a channel of a certain size is provided, with the interest on the cost of a larger channel, capable of meeting a greater storm.

A careful study of the rainfall records has led to the conclusion that the new channel of the Rocky Fork should be designed to carry an amount varying from 1,200 cubic feet per second at the junction of Touby's run with the Rocky Fork, to 1,600 cubic feet per second at the location of the disposal works. Below this point, the value of the adjoining property does not justify any further increase in its cross-section.

The above figures are based on a rainfall lasting one hour, at the rate of 2.0 inches per hour, for the unimproved portion of the watershed above Mansfield, and a rainfall lasting twenty-five minutes, at the rate of 3.5 inches, for the city itself. The runoff from the rural area has been calculated by the Burkli-Ziegler formula, and from the city by the more rational method of the percentage of impervious area and time when all portions of the shed become tributary to the channel under consideration.

Although, as already stated, this improvement of the Rocky Fork is not absolutely necessary, it is a municipal undertaking which should be

carried out in the near future. The resulting betterment to property in the low area will be great, the facilities for the carrying off of storm flow will be improved, and the water table of the adjacent property permanently lowered, a result which always leads to improved hygienic conditions.

The sewage pumps will be run throughout the twenty-four hours, and will, therefore, necessitate the attendance of one man during the night. To efficiently dispose of the garbage, and to give the filters what attention is necessary, three men will be required during the day; one of these men to have general charge of the sewage and garbage disposal, and the two assistants to divide their time between the operation of the garbage crematory and the beds.

The yearly cost is estimated as follows:

One man in charge of the works.....	\$ 900 00
Three assistants	1,800 00
Coal for pumping (1,000,000 gallons of sewage per day)....	375 00
Fuel for garbage disposal, (10 tons of garbage per day).....	450 00
Total	<u>\$ 3,525 00</u>

The total estimated cost of the disposal plant is as follows:

Low level outfall.....	\$ 11,500 00
High level siphon.....	2,000 00
Pump well and screens.....	2,550 00
Pumping station and crematory.....	9,000 00
Pumps and boilers.....	3,000 00
Septic tanks	15,870 00
Bacteria beds	19,850 00
Land ..	8,000 00
Garbage crematory	6,000 00
Total	<u>\$ 77,770 00</u>
Ten per cent. added for contingencies.....	7,777 00
Total ..	<u>\$ 85,547 00</u>

Of this total cost \$12,000 may reasonably be charged to garbage disposal.

The estimated yearly cost of maintenance is \$3,500, of which \$1,500 may be charged to garbage disposal.

The plans, after having been duly considered by the Board, were approved as presented, and due notice of this action was presented to the City Council of Mansfield January 13, 1900.

REPORT ON SEWAGE AND GARBAGE DISPOSAL FOR MARION.

At the meeting of the Board, held January 24, 1900, Mr. F. Herbert Snow, as Consulting Engineer, presented plans for a sewage purification plant for the city of Marion.

Following are the essential features of the report:

The city of Marion is situated in the flat basin of the Little Scioto, about two miles east of the stream. No natural water courses of any considerable size are found within the boundaries of the city, and the nearest outlet for drainage purposes is Rock Swale ditch, an artificial channel emptying into the Little Scioto. The city lies in the midst of a particularly rich farming district, and because of this fact and also because of the very excellent railroad facilities, due to the concentration of many roads at this point, it is destined to become a large manufacturing center. Already it contains large works of several standard manufacturing industries, and there can be no question but that its growth will be rapid and sound.

The land within the city limits has sufficient slope to make possible good sewerage and drainage. Referred to a datum 100 feet below the bench mark at the court house, the ground varies from about elevation 50 in the northwesterly part of the town to somewhat above elevation 100 in the southeast. The principal conduits of the surface drainage system are two large brick drains, one emptying into the Rock Swale ditch, on an extension of Silver street, and the other into Columbia street ditch, on an extension of this street.

The population of Marion in 1880 was 3,889, in 1890 it was 8,327. If the above figures for population are compared with the enrollment of school children and the electoral vote of the same year, it is found that the population was 5.36 times the enrollment and 4.26 times the vote. Using these ratios, the present population on the basis of the present enrollment would be 11,776, and on the basis of votes 12,527. It is probable that the 1900 census will show that there are not far from 12,500 people in the city of Marion.

The sewerage system as thus far constructed is entirely on the separate plan. There are about ten miles of pipe within the city limits, 17.3 per cent. of all the streets in the city being sewered. Of the streets within 2,000 feet radius of the court house 54 per cent. are so supplied; of the streets in the area between 2,000 and 4,000 feet radius 32 per cent., and of the streets beyond the 4,000 foot radius 4 per cent. are so supplied. Allotting the population according to the vote by wards, as has already been done in the estimate of people supplied with water, it is believed that about 4,500 people have access to the sewers.

The two principal interceptors meet at the corner of Kenton avenue and Silver street, from which point an 18 inch outfall carries the sew-

age to the Little Scioto. The greater part of the sewage from the city finds an outlet through the 15 inch Kenton avenue sewer, which, besides intercepting the Center street sewer, extends through Columbia street and collects the sewage from the east portions of the city.

To ascertain the amount of sewage flowing in a dry period at the outlet of the 18 inch sewer in the Scioto river, gagings were taken every half hour for a week, and the following table shows the result of these measurements and also the water consumption for the same time:

TABLE No. 3, SHOWING DAILY FLOW OF SEWAGE AND WATER CONSUMPTION FOR THE WEEK OF OCTOBER 20-26, 1899.

Day.	Flow of sewage.		Water consumption— Gallons per day.
	Cubic feet per second.	Gallons per day.	
Sunday, October 22.....	.365	237,000	630,230
Monday, October 23.....	.445	288,000	669,180
Tuesday, October 24.....	.438	284,000	640,045
Wednesday, October 25.....	.463	300,000	675,329
Thursday, October 26.....	.466	303,000	638,663
Friday, October 20.....	.411	266,000	730,245
Saturday, October 21.....	.409	265,000	667,740
Average ..	.....	277,570	665,347

It is evident from the above table that there is comparatively little difference between the Sunday and the week-day flow of sewage, again indicating a small manufactural flow of sewage. After subtracting from the water consumption the amount used by the railroads, it is evident that the greater part of the water used at present finds an outlet through the sewer system.

The following table shows the hourly variation in rate of sewage flow as ascertained by weir gagings:

TABLE No. 4, SHOWING HOURLY FLOW OF SEWAGE, AS OBTAINED BY WEIR GAGINGS.

Hour.	Gallons per hour.	Per cent. of 24 hours flow.	Hour.	Gallons per hour.	Per cent. of 24 hours flow.
1 a. m.....	9,300	3.44	1 p. m.....	13,300	4.93
2 a. m.....	8,900	3.29	2 p. m.....	13,700	5.08
3 a. m.....	8,600	3.19	3 p. m.....	12,650	4.69
4 a. m.....	8,700	3.22	4 p. m.....	12,200	4.52
5 a. m.....	9,400	3.48	5 p. m.....	12,500	4.64
6 a. m.....	16,300	3.82	6 p. m.....	11,950	4.43
7 a. m.....	11,300	4.18	7 p. m.....	11,800	4.38

TABLE NO. 4—Concluded.

Hour.	Gallons per hour.	Per cent. of 24 hours flow.	Hour.	Gallons per hour.	Per cent. of 24 hours flow.
8 a. m.....	11,750	4.34	8 p. m.....	11,700	4.33
9 a. m.....	12,350	4.57	9 p. m.....	11,100	4.12
10 a. m.....	12,350	4.57	10 p. m.....	10,500	3.89
11 a. m.....	12,800	4.74	11 p. m.....	10,000	3.70
12 a. m.....	13,100	4.86	12 p. m.....	9,700	3.59

This table is of value in estimating velocity at different times of the day, and in determining the necessary storage capacity to equalize the hourly flow.

The watershed of the Little Scioto at a point just below the outlet of the present sewers has an area of about 109 square miles. A record of the height of water in the stream at the location of the Marion water works, covering the years 1890 to 1898, inclusive, has been obtained, but owing to the extreme low water no opportunity has been afforded of obtaining the hydraulic elements of the water course at this point, and our estimate of the stream flow must therefore, be based on the rainfall as recorded at Marion, kindly furnished us by Dr. Raffensperger, and the percentages of runoff known to hold good on other streams under similar conditions. The record of stream heights at the pumping station has, however, been made use of and found to be of real value in checking the relative monthly discharges, and in arriving at the correct percentage of runoff.

The following table indicates the probable flow in the Little Scioto, prepared as just described, in the years 1891 to 1899, inclusive:

TABLE NO. 5, SHOWING ESTIMATED AVERAGE FLOW OF LITTLE SCIOTO, IN CUBIC FEET PER SECOND, FOR EACH MONTH FROM 1891 to 1899, INCLUSIVE.

Year.	January.	February.	March.	April.	May.	June.	July.	August.	September.	October.	November.	December.
1891	327.0	512.0	295.0	348.0	47.0	69.0	8.4	13.5	1.5	2.2	102.0	195.0
1892	69.0	.....	118.0	301.0	290.0	51.8	10.9	12.1	5.0	1.5	43.0	62.0
1893 .....	.....	.....	.....	.....	509.0	49.0	8.8	1.1	2.9	1.2	21.0	157.0
1894 .....	.....	.....	.....	.....	.....	.....	4.7	2.4	3.2	3.8	11.9	40.5
1895	250.0	12.4	46.0	4.8	14.4	19.2	2.1	5.2	2.5	2.7	14.2	119.0
1896	61.2	174.0	206.0	415.0	37.4	46.0	175.0	20.1	62.0	1.5	1.3	97.0
1897	61.0	229.0	370.0	212.0	172.0	26.9	23.0	2.9	1.3	0.8	109.0	98.0
1898	365.0	401.0	610.0	260.0	162.0	36.5	8.4	8.1	7.7	53.5	67.0	90.0
1899	428.0	236.0	464.0	231.0	102.0	68.9	4.7	7.5	2.6	3.4	43.0	.....
Average	223.4	259.7	305.6	253.1	154.2	45.9	26.2	8.1	9.8	8.8	45.8	107.8

While this table is of considerable value in estimating dilution, it is the minimums which are most important, and the following digest showing the minimum runoffs for different periods is accordingly presented:

TABLE NO. 6, SHOWING MINIMUM FLOW OF THE SCIOTO FOR DIFFERENT PERIODS.

Period.	Cubic feet per second per square mile.	Total flow.	
		Cubic feet per second.	Gallons per 24 hours.
Dryest 1 month, October, 1897.....	.0070	0.800	518,800
Dryest 2 months, Sept., Oct., 1897.....	.0090	1.050	654,000
Dryest 3 months, Aug. to Oct., 1897.....	.0122	1.333	860,000
Dryest 6 months, June to Nov., 1895.....	.0705	7.650	4,940,000
Dryest 1 year, 1895.....	.3760	41.042	26,600,000

Experience has proved that under average conditions 4 cubic feet per second of flow in the stream will dilute the raw sewage of 1,000 people beyond the point of possible nuisance. With this in mind, it is evident from an examination of table No. 5, that the Little Scioto is capable in the average year of diluting the sewage of a population several times as great as now exists in the city of Marion. A nuisance can only result from the present flow of sewage in the months of minimum flow. That at such times a nuisance is created needs no theoretical demonstration, and our object in discussing this phase of the problem is to emphasize the fact that the amount of sewage which can be safely turned into a stream depends upon the amount of water flowing, or, in other words, the degree of purification which it is necessary to attain in an inverse ratio of the stream flow.

It is evident from table No. 5 that during some months of the year only partial purification is necessary, while in other months, as shown in table 6, a high degree of purification will be required to prevent a nuisance.

The practical deduction from these facts is that the disposal plant should be as elastic in operation as possible — that it should be so planned as to make possible the correlation of the effluent, in the degree of purity obtained, with the stream flow.

Thus far it has been assumed that the effluent will flow directly into the Little Scioto. It will be shown in later pages that the proposed design makes possible the discharging of the effluent from the disposal works either into the Scioto through the present sewers, or into Rock Swale ditch.

The combination of septic tanks and back-flooded bacteria beds is recommended for Marion.

The collecting point for the present and future sewage of the city is naturally at the junction of Kenton avenue and Silver street, and as a right of way has already been acquired for the present 18 inch outfall the natural location for the disposal works is somewhere on the line of

the present sewer. A desirable site for the disposal works must include in its attributes nearness to a water course for the discharge of the sewage effluent, nearness to a railroad for the obtaining of supplies necessary in the disposal of the garbage, and be so situated that its elevation makes possible a gravity outflow of sewage and the operation of the plant without interference by floods.

After examining the possibilities of the various locations, it has been concluded that the most suitable location for the disposal plant is just south of the Big Four railroad, on the line of the present interceptor, and on the land of Mary J. Woolford. This location will permit the construction of the new interceptor, which will be necessary to obtain a gravity discharge, without buying new right of way, and it will enable the effluent to be flowed either into Columbia ditch through a pipe also laid in the present right of way, or through the present sewer to the Scioto. It is within reasonable distance from the city, for the disposal of garbage, and can be reached without the construction of any length of new roads. It is, at the same time, not too near the city to depreciate future values of land which, in a few years, will enter the market as available sites for residential and business property. Any location nearer the city would inevitably result in either a limitation of growth in its vicinity, or the relocation of the plant within a few years, at a greater distance from the center of population. The proposed site is the nearest point at which works can be economically constructed to operate by gravity.

Different structures are economically designed for different periods of time; thus, while a sewer in a deep cut is profitably made capable of meeting the requirements of forty years hence, water pipe in shallow cuts is usually based upon a period of twenty to twenty-five years, while in the case of filter beds and septic tanks, which can be extended at any time without extra cost over present construction, a capacity but little in excess of present demands is justified.

It may be well, with the above statement in mind, to briefly examine the premises upon which the design of the various portion of the disposal works at Marion is based.

From a curve plotted in comparison with the growth of other cities, the future population of Marion is estimated as follows:

1910.....	20,000
1920.....	30,000
1930.....	47,000
1940.....	75,000

It has been shown that the present consumption of water and outflow of sewage is at a rate somewhat less than 65 gallons per capita. It is believed that an allowance of 75 gallons per capita for future use is

sufficient. On the basis of the above estimate of population, and this per capita rate of consumption, the future use of water will be as follows:

1910.....	1,500,000
1920.....	2,250,000
1930.....	3,450,000
1940.....	5,625,000

The outfall sewer will be in a very shallow cut, and a capacity for a period longer than twenty years is not justified. It would therefore appear that a pipe capable of carrying slightly more than 2,000,000 gallons will be sufficiently large.

The septic tanks and bacterial beds should be made capable of disposing of the sewage which will result from an extension of sewers to meet the necessities of the present population. It has been estimated that 4,500 people are now provided with sewers. It is believed that with a satisfactory means of disposal, the system, in a short time, will be extended to all the territory within 4,000 feet radius of the Court House; that this area contains ten thousand people, and that the dry weather flow from this number of people will amount to 600,000 gallons. On the basis of this probable amount the septic tanks and bacterial beds have been designed.

The outfall sewer ends in a circular screen and gate chamber nine feet in diameter, located so that the contained gates govern the flow of sewage to the septic tank or to the beds, so that the superimposed tower forms a portion of the crematory house.

It is not always considered necessary to screen sewage which is to be subjected to septic action. In view of the possibility of raw sewage being at times applied to the beds, and also because of the excellent opportunity to remove and burn the screenings in the crematory, a screen has been provided. It will consist of a counterbalanced cage which, when full, will be raised to the level of the garbage dumping floor, where screenings will be emptied directly into a cart and immediately discharged into the crematory. The screen house will contain two gates, one of which governs the pipe leading to the septic tanks, and the other governs the by-pass through which the raw sewage can be flowed directly to the beds without treatment.

The septic tank is a covered masonry reservoir, built entirely of concrete except the brick piers and arches.

The total capacity of the tank—600,000 gallons—is divided into four units of 150,000 gallons each, in order to make possible the cutting out of any one unit. Experience has indicated that the exposure of the sewage to the action of the anaerobic bacteria for twenty-four hours is the optimum period, and it is upon this basis that the septic tanks have been estimated to have a daily capacity of 600,000 gallons. There is little difference in the results of an eighteen hour exposure, however, and the

tanks will undoubtedly be able to handle well up to 1,000,000 gallons per day with good results.

The desirability of a regular rate of flow throughout the tanks has been recognized, and the use of a reservoir to equalize or nullify the hourly variation has been considered. It has been concluded, however, that no independent reservoir is necessary, but that it is possible to so arrange the discharging orifice of the septic tank as to make this tank act as an equalizing reservoir. To accomplish this it is proposed to use such an orifice that the distribution will not be much affected by the rise of several inches in the tank, and to thus make possible a slight increase in storage during the maximum day flow. The springing line of the arches is placed six inches above normal water level; in time of maximum flow it is proposed to allow the sewage to rise up to the springing line. This rise of six inches is equivalent to a capacity of 44,000 gallons or practically the storage necessary to equalize a flow of 1,000,000 gallons distributed as is the hourly flow of the sewage at Marion.

The sewage enters at three points in each unit, in order to obtain as nearly as possible a uniform velocity throughout the entire cross-section. The effluent leaves the tanks through a slotted pipe bracketted to the wall at a depth of two feet below the water line, and through this pipe it is carried to an outside chamber extending across the entire length of each unit, where it is subjected to supplementary sedimentation. From this chamber it passes through the controlling orifice at a considerable velocity, and in such a way as to thoroughly free the liquid of the gases resulting from the anaerobic treatment. Connecting with these chambers and directly opposite the point of discharge of the orifice are vitrified pipes which lead to the chimney of the garbage crematory. In this way all the odors which might arise from the septic effluent will be rapidly carried off and harmlessly discharged from the top of the stack.

After being thus sprayed and freed of its gases, the effluent flows to an aerating chamber, where it runs over a slope provided with riffs, and is thoroughly exposed to the atmosphere. In this way it is believed that the amount of dissolved oxygen will be effectively increased and the effluent thoroughly prepared for the aerobic action, upon which its purification in the bacteria beds depends.

The inlets and outlets to the septic tank are trapped, and the tank is practically air tight, although manholes permitting entrance into each section will be provided. A drain which passes through the bottom of the outlet and aerating chambers makes possible the emptying of any single tank to elevation 32.0 and of the entire tank by pumping the remaining three feet into the first section of the aerator chamber, from whence it will flow to the beds. Provision is also made for by-passing raw sewage directly to the beds without septic treatment.

The first section of the aerating chamber contains two gates which permit the sewage to be turned either to the beds proposed for present

construction, or to those which will be built in the future. In the design of the septic tank and system of handling the sewage and effluent, an endeavor has been made to carefully separate the anaerobic and aerobic treatments of the sewage; experience has proved this to be essential to success, and it is believed that the plan proposed will accomplish this in a most efficient and economical manner.

The set of bacteria beds proposed for present construction is circular in plan, has a total area of six-tenths of an acre, and is divided into five sections, each with an area of 0.12 acre.

From a personal examination of a large number of mines, supplemented by chemical and mechanical analyses, it has appeared that slack coal with the finest portion of its constituents removed, is an ideal material for use in back-flooded beds. Large accumulations of slack are found at many mines—in some cases interfering with the economic management of the works. Quantities of it are being daily hauled from the tippie and deposited in the waste bank. Its cost will be principally that of screening and freight. In estimating the bed material, the price has therefore been made high enough to cover the cost of using slack coal. There is, however no intrinsic value in this material, and it may be found more economical to use crushed rock obtained nearer the location of the disposal plant. No such material, in sizes suitable for use, has been found, and it is doubtful whether the necessary physical conditions of fineness and yet absence of extreme dust can be economically obtained.

The operation of the beds will be automatically governed, and no attendance other than that required by any similar piece of mechanism will be necessary in the handling of the sewage. Four beds will be in commission at a time, the fifth being thrown out for periods of rest of a week or more. Of the four in use one will be filling, one standing full, one emptying and one resting, and the distributing mechanism will not only effect this distribution of the several factors in the process of purification among the four sections at a great saving in cost of labor, but with a regularity impossible of attainment by any other means.

The carriers will be constructed of concrete with plank sides, the width being reduced at each outlet to the sub-carriers in such a way that a uniform depth will be maintained throughout. The sub-carriers will be made of one-half or channel pipe.

The underdrains will be of vitrified pipe laid with open joints, the upper surface of the pipe being at the bottom of the bed material. Provision will be made so that the drains can be back-flooded and remain full at all times, if this is found desirable, in order to prevent a possible turbidity in the first rush of the effluent. The underdrains will be few in number, and the effluent will flow laterally through a layer of coarse material, the object being to insure that all sewage will come in contact with the bed material and not directly enter the underdrain pipe without being sufficiently subjected to the purifying action of the bacteria.

The main underdrain will enter a back-flooding chamber, into which will also flow the pipe in the aerator chamber, from which septic effluent will be discharged directly to the stream in times of high water. In the back-flooding chamber a wall with its top at elevation 29 will prevent back-flooding of the beds. From this chamber an 18-inch pipe will lead to a chamber on the line of the present 18-inch sewer from which two pipes governed by gates will permit the discharge of the effluent from the beds or septic tanks, either directly into Columbia ditch or through the present 18-inch sewer to the Little Scioto. The surface of the beds is to be at elevation 31, the bottom of the bed material at elevation 26. The known flood limits at the site of the filters is at elevation 28, and the stop wall, as already stated, in the back-flooding chamber has been accordingly placed at elevation 29.

The combination of sewage and garbage disposal works is of much value and should always be arranged wherever possible. In a city of the present size of Marion, such a combination will enable the combined works to be operated with practically the same amount of labor as each would require separately; it will enable the sewage screenings to be readily and easily burned in the incinerator, and will also afford a means of carrying off such odors as may arise from the septic effluent, and of harmlessly discharging them from the top of the stack. It is also desirable, on general principles, to concentrate the works for the disposal of city refuse at one point. As has already been intimated, it is proposed to locate the garbage crematory at the site of the sewage disposal works, just south of the Big Four railroad and 800 feet west of Campbell pike. The location is extremely desirable; it is beyond the limit of immediate growth of Marion, and yet within reasonable length of haul. It is near a railroad, and coal can be economically handled.

Such part of the garbage of Marion as is systematically collected is at present disposed of by dumping into an old quarry about one-half mile from the court house. It was formerly hauled about four miles into the country. Several men, by arrangement with the householders, collect and haul away the swill. The man who does most of the work hauls one load of about 5,700 pounds per day, this amount being collected from one-half the business district and one-twentieth of the residential district. It is estimated that if a thorough system of collection were instituted there would be obtained daily from ten to twelve tons of garbage. Ashes and street sweepings are at present used for filling.

With the above estimate in mind, it is proposed to build a fifteen-ton crematory, building a house of sufficient size to accommodate another unit of the same capacity when necessary in the future.

The total estimated cost of the disposal works is as follows:

Outfall sewer	\$4,770 00
Screen well, screens, gates, etc.....	1,150 00
Septic tanks	12,700 00
Bacteria beds	15,590 00

Crematory house and crematory.....	12,600 00
Land for disposal works.....	600 00 .
Total	<u>\$47,410 00</u>
Ten per cent. added.....	4,741 00
	<u>\$52,151 00</u>

Of this amount \$12,500 may be reasonably charged to garbage disposal.

The estimated yearly cost of maintenance is \$2,200, and of this amount \$1,500 may be charged to garbage disposal.

The Board voted to approve the plans for the disposal of the sewage of Marion with the provision that the plans presented by the Consulting Engineers be carried out in their entirety, to the end that the product of the septic tanks be properly purified, and notice of such approval was sent to the city council, of Marion on January 26, 1900.

REPORT ON SEWERAGE FOR SOUTH BROOKLYN.

At a meeting of the Board held in Cleveland, August 16, 1899, a committee of the Board of Health of South Brooklyn, accompanied by the engineer, appeared before the Board and asked approval for the construction of a sewer for said village, to discharge into the Cuyahoga river; the sewer to be used for both sewage and storm water. At that meeting the Board adopted the following resolution which seemed to fully cover this case:

Resolved, That the Board is not willing to approve any plan of sewage disposal which contemplates the discharge of crude sewage into Lake Erie or the Cuyahoga river at any point within ten miles of the intake of Cleveland's water supply.

Under date of February 10, 1900, the following communication, signed by three members of the Board of Health of South Brooklyn, was received:

At your last meeting in the city of Cleveland, a committee composed of members of the Board of Health of the village of South Brooklyn, Ohio, presented plans and specifications for the enlarging and extending of the so-called sewer system of the village for your approval.

Lack of time and the very elaborate presentation of the Lakewood sewer project by Prof. Elliott prevented this committee from entering upon the details and explanations of the plans contemplated by the village necessary for your body to understand all the facts and conditions as they exist regarding this improvement. Hence, we take the liberty of again presenting this matter to you for careful consideration and in so doing, wish to call your attention to a few facts, we were not permitted to lay before you at that meeting.

First. We have now a sewer in Pearl street running in a northerly direction and discharging into Big creek, a stream that enters the Cuyahoga river at a point about seven miles from the lake. This stream from the Cuyahoga river to a point one mile above our sewer entrance is entirely within the boundary of our village, and at the present time there is not a single house connection on this so-called sewer.

The city of Cleveland has also a sewer in Pearl street running in a southerly direction and discharging into Big creek immediately opposite our sewer outlet. This city sewer drains a territory nearly ten times the area of South Brooklyn; that is to say, if every house in the proposed sewer district of this village had a sewer connection and was used in a sanitary way, the amount of sewage would not then equal one-tenth of the quantity dumped into this creek daily from the Cleveland sewer. We, the local board, have thus far been unable to explain to the satisfaction of the majority of our thinking citizens why the village of South Brooklyn is refused permission to empty its storm water and cellar drainage into a creek within its own boundary that was appropriated twelve or fifteen years ago by the city for this purpose without permission and against the protest of our citizens, rendering the stream useless for any other purpose and a stench and disease breeding menace to the community with its constantly increasing volume of sewage.

Mention of these facts need not lead you to suppose that this board asks for permission or in any way countenances the pollution of the water supply of the city of Cleveland, which is now furnishing us with water for *fire protection* and in the near future we must look to them for our supply for all purposes, our wells being shallow and water objectionable on account of surface contamination. We have a self interest in preserving the waters of Lake Erie in their present pure state and we protest against this nuisance within our boundary now, as we have in the past when we have on more than one occasion brought this matter to your notice. Our recent silence in this connection is explained by the fact that the city of Cleveland at the present time is expending large sums of money in constructing intercepting sewers to remedy this evil and we are waiting patiently, and hope that ere long the sewage from Pearl street and South Brooklyn will be finding an outlet in the large intercepting sewer instead of the waters of Big creek and the Cuyahoga river.

Second. The permanent improvement of Pearl street, the main thoroughfare of our village, and the constantly increasing traffic thereon, has been a subject for deep and serious reflection on the part of the council and property owners on the street for a number of years past.

Universal belief now is that a pavement is imperative and they are ready and anxious for the improvement to begin at once. We already have the city gas and water pipes laid in some of our streets and the work is still under way in others, and before we go to the expense of paving we deem it advisable to increase the depth and capacity of our

sewer so that when the time comes when we will need a sewer for sanitary purposes we shall not have to tear up our streets.

All these improvements our village is willing and anxious to make, and can bear the expense without much hardship; but if compelled to put in operation and maintain a disposal plant in connection with the sewer to purify storm water and cellar drainage which ultimately find their way into Big creek, already contaminated with Cleveland sewage, it will preclude the possibility of this village proceeding with these much needed improvements, or compel the useless expenditure of a large sum of money.

And now, gentlemen, are we asking anything that is unreasonable or unjust under the circumstances? We ask you for permission to enlarge and extend our sewer. For the present it can only be used for drainage. When the time comes, which it will in the future, when we can have city water for domestic use and house connections with our sewer, our village then will be in better shape to meet that emergency and expense than at the present time. At that time, and when the city of Cleveland, either by intercepting sewers or otherwise, has removed the outlet of its sewer from Big creek, and out of our boundary, the village of South Brooklyn stands ready to dispose of its sewage, either by pumping it over into the Cleveland interceptor or, disposing of it in some other way that will meet with your approval.

We hope that this statement of the facts in the case will aid you in arriving at a verdict that would be just and fair to our village, and that you may see your way clear to grant our request.

Accompanying this communication was a resolution by the council of the village of South Brooklyn, concurring in the application and statement of facts presented by the board of health, and requesting the State Board of Health to take immediate action in reference thereto.

A map of the village and plans showing location by the proposed sewers were also submitted.

Under date of October 19, 1900, the village clerk of South Brooklyn was notified that the State Board of Health had approved the construction of a 5 foot, storm water, sewer in Pearl street, and a 22 inch sanitary sewer discharging into Big creek.

REPORT ON SEWERAGE FOR TOLEDO. DISTRICTS NOS. 34, 35, AND 27.

Mr. W. F. Brown, city civil engineer of Toledo, presented, for that city, plans for Sewer Districts Nos. 34 and 35. The outlet sewer for District No. 34 was to the Maumee river at Treadwell street. The outlet for sewers for District No. 35 was to the Maumee river between La

Salle and Mackinac streets. The combined system of sewerage was proposed for both districts.

The matter being duly considered, the plans were approved by the Board. Notice of such approval being sent to the engineer under date of December 21, 1899.

At the meeting of the State Board of Health, held January 25, 1900, the city engineer and some members of the city council of Toledo presented a request for the approval of certain modifications in the plans for Sewer District No. 27, which had previously been approved by the Board. The modification in plans was to carry the sewers for District No. 27 to a ravine in Valley street, and provide temporarily for their outlet at this point.

Dr. Chapman was appointed a committee to investigate and report upon the proposed plans.

At a meeting of the Board, held May 8, 1900, Dr. Chapman reported verbally upon these changes and recommended that they be disapproved.

The Board voted to disapprove the proposed modification and changes in the plans, and notice was sent to the engineer May 10, 1900.

REPORT ON THE SEWERAGE OF WARREN.

BY BENJ. H. FLYNN, ENGINEER OF THE BOARD.

The city of Warren has a population of about 10,000, over half of which it is claimed are using the sewer system. About one-half of the central portion of the city is drained to what is called the "Market street sewer", an old combined sewer which has been in existence for some thirty years. The remainder of the city is drained to the so-called sanitary sewers, which also carry much storm water. There are three trunk lines for the central and eastern portions of the city, only one of which, the "Pine street" sewer, is used to any great extent. The other two, known as the "Canal" and "Red run" sewers drain less thickly settled portions and have as yet but a few connections. The west side is drained by "Foster Gulch" and "First street" sewers, neither of which as yet carry much sewage. Near the outlet of the old "Market street" sewer an interceptor has been put in which carries part of the dry flow of this sewer to the "Pine street" sewer. This interceptor is now being remodeled so that an 8 inch stream will be diverted.

No accurate data could be secured in reference to the number of connections so the estimate of the sanitary policeman that more than 50 per cent. of the houses are connected will have to be accepted. In all there are about 13 miles of sewers, accessible to 75 per cent. of the people.

In reference to the condition of the sewer outlets, an examination made on the morning of the 20th of September 1900, showed the following: (A slight rain had fallen the night before but it did not seem to have affected the flow.)

The "Market street" sewer was discharging a rather dilute sewage, which had however deposited a large amount of foul smelling sediment in the bed of the stream. This sewer was causing more nuisance than usual, it is claimed, as the mill dam below was being repaired and the water was drawn down. Many complaints are made of the nuisance caused by this sewer, both from the people living near and from those compelled to pass it. It empties under the principal bridge for east and west travel. No doubt this nuisance could be easily abated by constructing a diverter to the "Pine street" sewer of such size as would carry the total dry flow.

The "Pine street" and the "Red run" sewers were discharging a large amount of sewage, most of it coming from the former, into the Mahoning river at the mouth of Red run. The river bed here is very wide and flat, much of it being bed rock and the flow is distributed in a thin sheet over this wide area. This tends to keep the sewage near the edge where it is emptied, causing it to deposit its sediment in the shallow pools and weeds. Red run is so low at its mouth that the sewage backs up into it for about 50 yards. There is a large accumulation of sewage mud at the outlets of these sewers which causes a decided nuisance for a good part of the year. The only reason that it is not complained of is that there is no one near to complain. The stream rapidly loses its objectionable character owing to the retention of so much of the solid matter near the sewer outlets.

The "Canal," "Foster's Gulch," and "First street" sewers were each discharging a small amount of sewage which had however deposited considerable foul smelling sediment but not enough to cause much of a nuisance.

During sultry weather the odor from the sewer outlets is plainly noticeable over quite an area of the lower portion of the city. No complaint seems to be made, it being taken as an unavoidable nuisance, something which must be endured.

From all that could be learned it does not appear that the sewage of Warren is causing a nuisance below the immediate outlets of the sewers. Of course its effect is serious on the emergency water supply of Niles and upon the regular supply of Youngstown.

If all the sewage were carried below the city and deposited in the channel of the stream it would probably cause no nuisance at present. An appreciable increase in the amount of sewage, especially after the lower dam is repaired, would cause a nuisance of such extent that it would no doubt be seriously complained of.

REPORT ON PROPOSED SEWERAGE AND SEWAGE PURIFICATION FOR XENIA.

At a meeting of the State Board of Health, held May 8th, 1900, the mayor, city solicitor, city engineer of Xenia, and the consulting engineer appeared before the Board and presented plans for a system of sewerage and sewage purification for that city, which they asked to have approved.

The plans provided for a separate system of sewers with sewage purification by intermittent filtration. The land selected for sewage disposal beds was located about one mile northwest of the city limits and could be reached by gravity. The land with two or three feet of strippings was represented to be of excellent quality for intermittent filtration, while immediately at hand several fine banks of sand and gravel contained an abundance of suitable material for the construction of filtration beds.

The Board voted to approve the plans as presented, and notice of this action was sent to the city council of Xenia.

Subsequently the Board was asked to approve a change in the location of the filter beds, as some difficulty had been experienced in securing land originally intended for this purpose. The engineer of the Board was sent to Xenia to investigate the location last proposed for filter beds and reported in favor of permitting the change in plans to be made.

This question having been submitted to the Board it was voted to approve the said change in plans, and notice was sent to the City Sewer Commission of Xenia, October 19th, 1901.

MISCELLANEOUS.

REPORT OF A NUISANCE AT ASHVILLE.

Complaint having been made of a nuisance at Ashville, Pickaway county, arising from defective sewerage, the engineer visited that place on May 21st, and reported as follows:

Ashville is a growing village with a population of about 700, but claiming 1,000. Its storm drainage is through a number of tile and brick sewers emptying into ditches which lead to Little Walnut creek. Most of these sewers have been put in since the incorporation of the village, but one or two before that time, and it is one of the latter class which is causing the trouble. The sewer in question is an 18-inch tile, about 300 feet long, and leads from the corner of Long and Main streets to a stone culvert over a ditch at the side of the N. & W. Railroad. This same stone culvert also receives the water from a 3-foot brick storm sewer, which now has a water closet and vault connected directly with it.

On the corner of Main and Long streets is a brick block, occupied by Dr. Squires, in which is located a water closet which is connected with an old tile which was cut off by the short storm sewer. This old tile receives the drainage from two yards above Dr. Squires, passes through, or rather under, the Squires building and receives the drainage from its bath and water closet and then empties into the storm sewer at an open storm water drop. The upper end of the storm sewer is low, or the sewer has been clogged up, as five inches of water was standing in same at the time of inspection, giving off objectionable odors, the cause of the complaint.

The two connections to the large storm sewer and the one of Dr. Squires are the only direct connections for closets or vaults with the drainage system of the village. The combined sewage from these three connections causes a nuisance at the stone culvert but this is not complained of as it is so far removed from any dwellings.

The question of a nuisance at the drop at the corner of Long and Main streets is admitted by all, but the method of abating it is not so agreed upon. The village claims that the sewer was put in for storm water only and that no closet drainage should be sent through it. Dr. Squires claims that the storm sewer cut off his private drain and that he is not responsible for the nuisance as the village should care for the wastes sent through its sewers. His point would be well taken but for the fact that his closet was put in after the drain had been connected to the sewer and when it was being used for yard drainage only.

There are two ways of abating the nuisance: Dr. Squires must remove the waste from his closet in some other manner than by turning it into the storm sewer, or the village must relay the sewer, as in its present condition it cannot serve as a sanitary or combined sewer though it is able to care for the storm water without objection.

Dr. Squires' property can hardly do without a sewer as it covers the whole lot, leaving no room for a vault or cess-pool, but it does not seem just to compel the village to put in 300 feet of sewer for the accommodation of one person.

REPORT ON THE CONSTRUCTION OF SEWERAGE AND THE ABATEMENT OF A NUISANCE AT BELLEFONTAINE.

The following communication was sent to the members of the State Board of Health May 23rd, 1900:

The city of Bellefontaine, through its mayor, has asked the Board to pass a resolution declaring it to be necessary for that city to introduce a sanitary plant for the purpose of disposing of garbage and sewage.

This resolution is necessary under the provision of a recent act of legislature which provides that "Whenever the State Board of Health declares it necessary for any city of the fourth grade of the second class to adopt measures for the relief and improvement of its sanitary condition, by the proper disposal of its sewage or garbage, or both, the city council of said city may, by resolution, authorize the establishment of a 'Sanitary Board' for the purpose of constructing, operating and maintaining, a 'sanitary plant' for the proper disposal of the sewage or garbage, or both, of said city in the manner hereinafter provided."

On page 73, of the annual report of the State Board of Health for 1894, you will find a report upon the conditions at Bellefontaine at that time, said report having been made by a committee of the Board. The conditions at Bellefontaine have grown worse and it is my understanding that damage suits have been started against the city from lack of sewerage.

Will you please vote for or against the following resolution:

Whereas, The city of Bellefontaine has applied to the State Board of Health for its opinion as to whether sanitary sewerage and works for the purification of the sewage and garbage were necessary for said city, and

Whereas, The State Board of Health has caused an investigation to be made, such investigation showing that such improvements are urgently demanded in the interest of public health, therefore, be it

Resolved, By the State Board of Health, that it is hereby declared necessary, and that it is earnestly recommended that a sewerage system and proper works for purifying the sewage and garbage of Bellefontaine should be installed at the earliest possible time.

The resolution was adopted by vote of the Board and notice was sent on May 28, 1900, to the mayor and council of Bellefontaine of such action having been taken.

June 2nd, the following communication was received from Mr. Luther Shuffleton, secretary of a citizens' committee of Bellefontaine:

We desire to call your attention to the dangerous condition of a stream commonly known as "Possnm run," in the city of Bellefontaine. It runs through the heart of the city from a northwesterly direction to a southwesterly course. Into it are emptied sewers, privy vaults, cess-pools, water closets, refuse from laundries, livery stables and other matter. More than seventy-five cess-pools and privies empty directly into the stream within three squares, and it flows immediately through a populous residence portion. During the summer season the water is very low in the stream, and the stench arising from the stream is nauseous and detrimental to the life and health of the city, and is very injurious to property also. Some of the privies are on the banks and directly over the stream, and the matter may be seen oozing and percolating through the walls into the water and into the stream. New dwellings and buildings and drains therefrom are being made, and no restrictions or regulations of the local board of health are named or demanded by any authority. The statutes make it the duty of the local board of health to abate all nuisances and regulate sewerage, but as yet neither has been done.

As early as November, 1899, the local board was petitioned by the citizens of the city to take some action relative to the condition of this stream. Meetings were called and the board were of the opinion that something ought to be done, and we are informed that about 75 notices were issued for citizens or violators to appear before that body and answer, and only two appeared, and others personally asked for time at a meeting on or about February 3, 1900. Resolutions declaring certain places nuisances were adopted, and since, nothing has been done. We herewith enclose a copy of the citizens' petition presented to the local board and a brief covering the same. May we ask you to read and return it soon?

We are informed by a letter from your department that your Board adopted a resolution declaring it necessary, and earnestly recommending that a sewerage system and proper works for purifying the sewage and garbage of Bellefontaine should be installed at the earliest possible time. For this we are very grateful, but if you will allow us, this is just what we desire to meet. What are we to do while this is being done or accomplished, i. e., sewerage the city? Of the two enabling acts — the Mansfield Act and the Dunham Act — counsel have been unable to agree upon their construction and effect. The possible manner of determining a plan for sewerage or providing for such is a mooted question, and, if it were possible, sewerage could not be put in short of a year, and the necessary connections would take a longer time, so it comes back to the question, "What relief can we have now?"

And under section 409-25 of the Revised Statutes of Ohio, we come to your honorable body for relief. The local authorities make a finding that these things are nuisances, and nothing is done to suppress, abate or regulate, hence under the above named statute we believe it lies within your province, "To make and enforce orders in local matters when emergency exists, and the local board of health has neglected or refused to act, etc." In this matter the "emergency" exists, and we heartily implore your attention and candid consideration of the matters mentioned. We would gladly pay the expense of a representative from your department or office to our city that we may more than verify what we state.

The matter was referred to the attorney general for his opinion as to the powers of the State Board of Health to take action in the case and his advice is set forth in the following communication, a copy of which was sent to the secretary of the citizens' committee of Bellefontaine:

Your communication of June 16th, containing enclosures in reference to the condition of a stream called "Possum run," in the city of Bellefontaine, Ohio, at hand, and you ask an opinion of this office as to whether the State Board of Health has authority in the event of the failure to act on the part of the local board of health to take measures to abate the nuisance referred to in said enclosure.

The only statute that it is necessary to consider in this connection is a portion of section 409-25, as follows:

"It (the State Board of Health) may also make and enforce orders in local matters, when emergency exists, and the local board of health has neglected or refused to act with sufficient promptness and efficiency, or when such board has not been established as provided in this chapter, and all necessary expenses so incurred shall be paid by the city, village or township for which services are rendered."

It will be seen from the above that the State Board of Health is only authorized to act in local matters "when emergency exists," and this only when the local board of health has failed to act or when no local board has been established.

The only question then left for consideration is, do the conditions at Bellefontaine, as set out in the petition to the local board of health, constitute an emergency within the meaning of the statute? I do not think so. It would appear that this so-called "Possum run" has been made the outlet "for sewers, privy vaults, cess-pools, water closets, refuse from laundries, livery stables and other matters." Doubtless this use of the stream has been one of gradual development, and the nuisance, if one exists, has been of gradual growth. It is probably not a great deal worse now than it has been for some time in the past. While it is doubtless an unfortunate condition of affairs, it is a condition which affects no one but the people of Bellefontaine, and they have allowed it to gradually increase until it is in its present condition. Under no reasonable definition of the word "emergency" can such condition as this be included. Emergency is defined to be "a sudden or unexpected happening: an unfor-

seen occurrence or condition; specifically, a perplexing contingency of complication of circumstances." (Century dictionary). "A condition or thing appearing suddenly or unexpectedly: an unforeseen occurrence: a sudden occasion." (Webster's dictionary.)

An emergency might arise when an epidemic of a contagious disease should develop in a community and there should be no local board of health established, or the local board of health should fail to act with sufficient promptness or efficiency. Under such circumstances the State Board of Health would be authorized under the section above quoted to make and enforce orders in local matters, but it is only when such emergencies as these arise that they have any such authority.

The provisions of the statute in relation to the establishment of local boards of health seem to contemplate that each community should be permitted to take care of its own local affairs so long as the public health is not threatened by sudden or unforeseen emergencies, and I find nothing in the statute above quoted that would authorize the State Board of Health to interfere unless some such emergency arose, which the local board of health were either not capable of handling or failed to handle with sufficient promptness and efficiency.

If the State Board of Health had authority to make and enforce rules in all cases whenever it felt disposed so to do, the local boards would be shorn of their authority and power, and the sanitary affairs of each community would be absolutely beyond the control of the community and placed in the hands of the State Board of Health. I cannot think that such was the intention of the legislature or that such would be a reasonable construction of the statute above quoted.

REPORT OF AN INVESTIGATION OF A NUISANCE AT BLANCHESTER.

Request having been made by the mayor and health officer of Blanchester, Dr. Byron Stanton was appointed a committee to investigate a nuisance complained of, and reported as follows:

I went to that village on August 18th to investigate a nuisance caused by a private sewer which receives sewage from a hotel, livery stable, saloons, business houses and residences in the center of the town and discharges into a small run that flows through the place. It is about half a mile from the outlet of the sewer to the point at which the stream leaves the corporate limits, and very near to the stream below the outlet are several residences, the occupants of which are subject to dangers and discomforts from which they wish to be relieved.

The sewer is a private one and was made several years ago for cellar drainage, but after its construction cess-pool and house connections were

made until now the amount of sewage discharged exceeds the ordinary flow in the stream. The result is a nuisance to which is ascribed the unusual amount of sickness prevailing in the families living along the polluted stream. So general is the belief that much of the sickness is due to stream pollution that a petition signed by over sixty persons residing in the affected territory was recently sent to the local board of health, and that board took such action as it thought necessary to secure the abatement of the nuisance. At a recent meeting a resolution was adopted declaring the sewer a nuisance and directing the health officer to serve a notice upon the offending parties to cut off all house and cess-pool connections within a specified time. When that time had elapsed without any compliance with the order, the board by resolution ordered the offending parties to appear before it on Tuesday, August 21, to show cause why they should not be proceeded against for disregarding the order. As the board was not sure as to its powers and duties and as there was some question as to how it should proceed in case of refusal to comply with the orders, I was requested to confer with it. I found the steps so far taken by the board to be in compliance with the statutes governing such cases and nothing now remains but for the local board to cause the arrest of all failing to comply with its orders. I see nothing that the State Board can do in this matter but to urge the local board to follow up its order by the arrest of the offenders.

While I was in Blanchester, my attention was called by Dr. S. B. Judkins, health officer, to the bad sanitary condition of the town. I was shown a number of sanitary defects by him. At one place a cess-pool discharges into a run that is dry nearly all of the year. At the time of my visit there was no water in it, except what came from the cess-pool. One privy used by a number of employes of a business establishment was over the same run. Another source of nuisance is caused by house drainage being carried to street gutters without proper provision for its escape. Near the intersection of Main street and Broadway the grade of the former street is so much lower than that of the latter that pools of water stand in the gutters which become very foul from urine and droppings of horses. The principal business streets are much in need of cleaning.

Most of the sanitary defects of the place could be removed by the adoption of a system of sanitary sewerage with purification of the the sewage and by the proper grading of the streets so that storm water and street washings could be speedily carried away. The town has a public water supply but the water is not fit for domestic use. The reliance must then be upon wells, and to preserve these in a safe condition soil contamination must be stopped at once. Vaults must be abandoned and dry earth closets substituted until a proper sewer can be made. The matter of sewerage and drainage, of course, belongs to the council, but I think the board of health will not have done its full duty if it does not call upon the council to take prompt action

to secure a much needed system of sewerage, which offers the only solution of the greatest problems that confront them.

After making the inspections above referred to, I met the mayor, health officer, and several members of the board of health and with them discussed the sanitary needs of the village. I urged upon them the recommendations herein contained, but I would be glad to have them sent to the local board with the endorsement of the State Board.

A copy of this report was sent to the health officer of Blanchester August 30th, 1900, and the local board of health was urged to carry out the recommendations therein.

REPORT UPON AN EXAMINATION OF THE HIGH SCHOOL BUILDING AT FINDLAY.

Upon the petition of two hundred and three citizens of Findlay, most of whom are mothers of children attending High School, the secretary made an inspection, assisted by Mr. Flynn, the engineer of the Board, of the high school building on November 13th, 1899. Mr. Zeller, superintendent of the public schools, rendered every possible assistance. The committee reported as follows:

The building is an old brick structure, erected about 1865. It is quadrilateral in form, and faces south. The basement extends considerably above ground, forming, practically, the first story. The fourth floor was originally an assembly room, but for some years has been used for high school purposes. While the first floor above the basement and most of the second floor are used for pupils in the primary and lower grades, it will be well to consider the building as a whole, with special reference, however, to its usage for high school purposes.

The basement, which extends under the whole building, is dry, but is badly lighted, in parts. Two of its rooms, floored with wood, are used by the children at noon as places to lunch. There is no great objection to this, except the additional stair climbing it makes necessary. The basement contains a steam boiler for heating the building. The system of heating is by both direct and indirect radiation. Steam pipes extend along the walls of all the rooms, and some of them also contain steam radiators. There are several steam radiators in the basement, boxed in with wood. The fresh air ducts to convey air to these radiators are also of wood. A wooden valve is placed on each main fresh air duct. Both of these were closed and one was fastened by nailing. The janitor stated that he had nailed it to keep the boys from opening it, and that he could not open these valves much of the time as they cooled his radiators too quickly. The wooden air ducts and boxing around radiators were full of large cracks, allowing an easy entrance of *basement* air. As a matter of fact,

but little use is made of the indirect heating system, although the anemometer showed, on opening a register in rooms above, that considerable air was passing upwards. Practically the only means for admitting fresh air to the school rooms or removing foul air from them is by opening the windows. This is difficult or impossible in cold weather, in some of the overcrowded rooms, as pupils must sit not more than two feet from the windows.

The lighting of many of the rooms is bad. Rooms 3 and 4 on the first floor (not counting the basement) and rooms 5 and 6 on the second floor are each 42 feet long. The windows are at one end of these rooms and it is completely impossible to properly light the entire space. In rooms 4 and 5 electric lights have been introduced, which must be used on cloudy days.

Room 3, of the high school, on the top floor, is $51\frac{1}{2} \times 44\frac{1}{2}$ feet. It contains windows on the north end and south sides, but the room cannot be properly lighted in this manner owing to its vast size, and nine electric lights have been introduced. The ceilings are quite high, being 15 feet on the first and second floors and 18.7 feet on the third or top floor. This unusual height increases the cubic space in the various rooms, but authorities on school hygiene agree that, as regards ventilation, we should throw out of count the space above 14 feet.

Many of the rooms are overcrowded. Room 2 on the first floor allows 14.8 square feet of floor space per capita, and room 4 on the same floor allows 15.8 square feet per capita. This is for the number that were actually present. The enrollment is somewhat higher and would decrease these figures. The condition as to overcrowding in the large high school room on the top floor is at times much worse than this. This room is used both as a class room and study room; pupils going from this room to four other rooms on the same floor for recitations. Some classes also descend to rooms on the floor below for recitation purposes.

The large room on the top floor has an enrollment of 292. This number is present only a part of the time. The average number present is about 162. There were 277 pupils present on the day the examination was made. When the full enrollment is present this gives for each pupil but 8.8 square feet of floor space. If we should consider this room as having a 14-foot ceiling (as regards available space for ventilation) it allows for the full enrollment but 124 cubic feet of air space per capita.

The first and second floors are reached by stairs, starting from the entrance on the south side. The stair cases are spiral in form and the steps are 5.4 feet wide. The pupils of the high school on the top floor have a separate staircase. This staircase is 3.7 feet in width. There are 72 steps to be climbed in ascending from the ground to the top floor. The spiral staircase also reaches the top floor, opening into the large room previously spoken of, but is used only by a part of the high school

scholars in descending to the second floor for recitation. In case of fire there would be very great danger of accidents to the children.

On the first and second floor, halls, or outside rooms, are used for hats and outer garments of pupils. On the top floor it is necessary that hats and garments should be hung in the recitation and study rooms, which at times is very objectionable.

The closet arrangements are the Smead dry closet, or rather a modification of this system. The air passing through the closets is taken out of doors and enters a stack which is imperfectly heated by a small gas jet, kept burning during school hours. The closets are placed in separate rooms, not a part of the building, but attached to it, and are entered from the basement. They were in fairly good condition when examined.

The foregoing brief description of this school building will show that it is very illy adapted to school purposes. The system of ventilation is the worst form that could be adopted in the absence of some special provision for removing foul air. The rooms are so large that it is impossible to properly light them, and the blackboards are necessarily placed in a bad position, which must be very injurious to the eye-sight of the children. The overcrowding in many of the rooms must be highly prejudicial to health.

The placing of a high school on what is practically the fourth story, necessitating daily excessive stair climbing on the part of boys and especially girls, at the age of puberty, is to be highly deprecated.

The arrangement of the stairs is such that in case of an alarm of fire, accidents would be almost unavoidable.

Findlay stands in need of a modern high school building, and the assurance given by the superintendent of schools that this need is felt by the school board and that there is every probability that such a building will be erected in the near future, is gratifying. It would be very desirable, however, in our judgment, if some arrangement could be made to secure temporarily a building or rooms which would at once permit of the vacation of the top story of this building, and until a high school building can be erected.

This report was approved by the State Board of Health and a copy was sent to the petitioners. It is satisfactory to be able to state that subsequently definite action was taken for the construction of a new high school building at Findlay.

REPORT OF AN INVESTIGATION OF A NUISANCE IN PERRY TOWNSHIP, WOOD COUNTY, CAUSED BY THE SEWAGE OF FOSTORIA.

In 1895 complaint was made to the State Board of Health that sewage from the city of Fostoria was causing a serious nuisance by polluting a small stream into which it was discharged. An investigation of the

alleged nuisance was made by the secretary, who reported the stream to be in a very bad condition. (See annual report for 1895, page 149.)

The attention of the authorities of Fostoria was called to this nuisance, and through active measures taken by the local board of health Fostoria consented to install works for the purification of its sewage. Plans for a sewage disposal plant were submitted to and approved by the State Board of Health. Work was commenced, but the plant, for various reasons, was not put in operation.

In July, 1900, a complaint was received from the board of health of Perry township, Wood county, that this stream was again cause for serious complaint on account of its pollution by sewage from Fostoria. Dr. W. C. Chapman was appointed a committee to investigate and report, and he submitted the following:

At the request of the president I visited Hatton and Fostoria last Friday evening, being the 3rd of August, was met at the former named place by Dr. C. B. Hatfield, health officer of Perry township, Wood county, and was taken to Fostoria by him in his buggy.

The situation is a peculiar one, as Fostoria is really in three counties, Wood, Hancock and Seneca.

The mouth of the sewer through which the sewage of nearly the whole of the city passes is situated in Perry township, and the stream, a small creek called the East Branch of the Portage river, runs through the fine farming land of Perry township. I examined the stream, so called, and found it a very sluggish water course. Do not think there was a mile an hour of flow, and it was polluted to a great degree by sewage brought down from Fostoria. The farmers are indignant, and I believe righteously so, as fine pasturage is rendered unavailable, the only water that can be given to the stock being necessarily taken from this creek. Cattle do not thrive and butter and milk sold from this region are not purchased by the people of Fostoria, they themselves not considering the water good.

By referring to the action of the State Board — 1895 and 1896 — it will be found that disposal works were promised and the plan was approved. At present, and for several years back, these works have not been in use, and raw sewage from 7,000 people has been pouring into this little sluggish stream of water to the great annoyance and risk to the farmers living along its banks. The disposal works can be rendered useful and will accomplish the purpose for which they were intended if repaired and new and modern machinery, adapted to such work, be installed. Desire to save the expenditure of sufficient money is all that stands in the way of abating the nuisance.

I also called upon Mr. Charles A. Strauch, city solicitor, and learned from him that immediate steps would be taken to repair or renew the disposal plant so that the sewage of the city will be prevented from flowing into the creek. I assured him that it was not wise to delay the matter

until the farmers and others bring suit for large damages against the city; that only wise action upon his part would prevent such action being taken; that the matter was now in the hands of the township authorities and a committee had gone to Bowling Green to institute the suit that day. I advised the health officer of Perry township to prevent such action for the present and he telegraphed them to await developments.

Having carefully considered the question, I would recommend the following:

First. That the local authorities of Fostoria be notified that they must immediately put in order the disposal plant as approved by the State Board of Health, and that in the future the same must be constantly in use, and that sufficient expert attention be at all times given to the plant, so that no pollution occur from the passage of sewage into the creek below.

Second. That the inhabitants of Perry township be informed of the action of this Board in the matter and assurance be given that all will be done to prevent a continuance of the pollution of the stream.

The report was approved by the Board and the authorities of Fostoria were notified that they must at once place the disposal works in order and give the plant sufficient expert attention to insure that no pollution would arise from the emptying of sewage into the stream.

REPORT OF AN INVESTIGATION OF A NUISANCE AT SABINA.

A petition was received, signed by the mayor, members of council, members of the board of health, the health officer, village marshal, and other citizens of Sabina, asking for an inspection by the State Board of Health of a nuisance existing on the northern confines of the village.

Dr. Byron Stanton was requested, as a committee, to visit Sabina to make an investigation and report. Dr. Stanton visited Sabina November 21st, and submitted the following report of his investigation:

The nuisance complained of by the petitioners consists of a pool of stagnant water north of the village, but within the corporate limits, in the bed of a small stream known as Wilson's creek. This pool is about a quarter of a mile long, is from 15 to 20 feet wide and two feet deep at its greatest depth. Into it is discharged the sewage from two sewers made about six years ago, which receive the washings of the streets, alleys and yards and the waste water from laundries and kitchens, but they have no water closet connections.

From four to six months of the year the stream contains no running water. The sewage and water from other sources runs into the pool about as fast as it evaporates or soaks away, so that at no time does the pool dry up. As might be expected, the contents of the pool are, in the summer months, very offensive, and as there are a number of wells not

more than 18 feet deep within 100 feet of the pool, there is a possibility that they may become contaminated.

In my opinion there are but two ways by which the nuisance can be abated. One is to fill up the pool so that the water will flow away; the other, and less expensive way, would be to drain it. To do this would require the deepening of the channel about half a mile. As the nuisance is in the corporate limits, and is largely created by the village sewers, it is my opinion that the work would have to be done under the direction and at the expense of the village of Sabina, although the draining would have to be done outside of the village limits.

I would recommend that the State Board of Health refer this matter back to the village authorities with the recommendation that they at once take measures to secure the abatement of a nuisance within their own limits and largely of their own causation.

From the official position held by most of the petitioners, I would think there should be but little delay in passing the necessary legislation to secure prompt relief.

The report was approved by the Board and in accordance with its recommendations, a copy was furnished to the local health authorities.

REPORT ON THE USE OF SEWER PIPE AS A CONDUIT FOR WATER AT SALEM.

A letter was received from Dr. A. C. Yengling, health officer of Salem, under date of April 23rd, 1900, in which the question was asked as to the advisability of using sewer pipe for the conduit to carry water from their supply wells at Garfield avenue station to the main pumping station on West Main street. With the understanding that this was ordinary sewer pipe, which was to be used, the advice was given that this would endanger the water supply of Salem. A report was received later from Mr. J. B. Strawn, C. E., showing that this conduit was to be constructed of pipe specially made for this purpose, and approving it. The report of Mr. Strawn was as follows:

This report has reference to the matter of constructing a conduit for conveying water from the supply wells at Garfield avenue station to the main pumping station on West Main street. The distance is 3,540 feet.

At different times I have carefully examined both the character and quality of the material going into the conduit; also the manner of laying the same.

The pipe used in this work is a patent, self-centering pattern, 12 inches in diameter, and three feet in length, exclusive of the bell. The material of which the pipe is made is a mixture of ground shale and clay. The claim is made that this mixture produces a strong, close and

tenacious body which makes a pipe specially adapted for such purposes. All of the pipe used on the conduit are hard burned and glazed both inside and outside.

This particular form of pipe has several advantages over the ordinary pattern of sewer pipe. The pipe is one-half longer than common pipe which correspondingly reduces the number of joints. The pipe has about twice the length of solid bearing on the bottom of the trench, after you deduct the space required for bell-holes.

The self-centering feature prevents the displacement of cement in the joint by pressure coming on the spigot end of the pipe. It also furnishes a space especially provided for driving in oakum saturated with neat Portland cement paste, which holds the spigot end of the pipe truly and firmly in the bell and allows the cement to be uniformly packed in and around the joint.

All things considered, I regard this design of pipe and the manner of connecting of the same as specially adapted for gravity conduits where the same are never under pressure, and where the pipe never runs full; or where the conduit is not in continuous service, as this one will be. The intention is to pump through the conduit about six hours each day.

The plan proposed for lifting the water from the artesian wells is to use compressed air. The plan is that known as "The Air Lift" which will deliver the water into a receiver located at the wells, at the head of the conduit.

The "Air Compressor" will be installed at the West Main street pumping station. The four inch pipe which now is used for conveying water from the artesian wells will be utilized for conveying the compressed air from the pumping station to the artesian wells.

The proposed plan of construction of conduit will at all times permit of critical examination, so that if at any time there should develop the smallest leak it can be readily detected. Both ends of the conduit will at all times be open, except while pumping, when the pipe will be partly filled with water.

The elevation of the ground at the artesian wells is about 75 feet higher than the ground at the West Main street pumping station. The conduit is laid on a continuous grade from the pump station to the wells. Hence when pumping ceases the pipe is promptly drained.

Under these conditions, were an iron conduit used, the daily alternation of wet and dry would soon induce rust to form, which, with the amount of water pumped, the rust would color the water. By the use of the proposed pipe there never could be any rust. It would always be clean.

S. E. Babcock, hydraulic engineer, of Little Falls, N. Y., designed and superintended the construction of the water works plant of that city, and used a large amount of sewer pipe conduit-laid in a similar manner as the one now under construction here for the Salem water works. Mr.

Babcock is the chief engineer for the water works and, as I understand, has been since the works were built.

Special precaution has been taken where the pipe is laid through low ground by completely encasing the joints with cement concrete. I believe that every precaution has been taken that would be necessary to insure a thoroughly good job.

I regard the present conditions much more favorable when considered from a sanitary point of view than at any time since the installation of the Salem water works plant.

It is with no little satisfaction that I now feel justified in making the foregoing statements. My views are well known in this city, as well as to the larger portion of the State Board of Health, as regards the character of the city water supply for several years past. It is a real relief to think that matters are looking so favorable.

At a meeting of the State Board of Health held on May 9th, 1900, the matter was presented, and the Board did not consider it necessary to take any special action in the matter, and no disapproval was expressed of the manner in which it was proposed to construct this conduit.

REPORT OF AN INVESTIGATION OF AN ALLEGED NUIS- ANCE AT SIDNEY, ARISING FROM IMPROPER DRAINAGE.

At a meeting of the Board held in Columbus, January 25th, 1900, the secretary presented a request from the board of health of Sidney for the State Board to examine and report upon the sanitary condition of that city, with special reference to the matter of sewerage. Dr. Frank Warner was appointed a committee to make an investigation and reported as follows:

As your committee, I visited the city of Sidney on the 29th of March, in company with Mr. Flynn, our engineer.

Some years ago the county commissioners constructed a private sewer for the purpose of affording drainage for the county jail and court house. From time to time, since then, numerous parties have connected into this sewer. Then, others have tapped their neighbor's sewer, which opened to what is known as the commissioner's sewer. The result of this is that the city has no regular sewer system. These few sewers never receive any flushing either from tanks or from storm water.

Only a very limited number of houses are attached here, the others, barring a few that run their waste pipes direct into the canal, are without sewers.

The commissioner's sewer empties into the Great Miami river in the town, above a mill dam which is situated at the lower end of the town.

Mr. Flynn made the following report to the committee :

Sidney has an estimated population of 5,880, but its citizens claim a little larger figure.

The village has considerable general manufacturing, among which are a gas works, tannery, brewery, and a small creamery which have objectionable waste products. The gas works and tannery send their waste to the canal and a nuisance is complained of and the brewery and creamery discharge their waste water to the river without complaint. The other industries consist of a broom factory, several machine shops, whip factory, pole and shaft works, foundries, flour mills, etc., none of which have objectionable wastes.

Sidney has an excellent public water supply from artesian wells, located in the upper part of town and removed from all local pollution. The mains are accessible to more than 90 per cent. of the total population and about 70 per cent. of the same have water in their homes for domestic use.

The general introduction of the public water supply, the several objectionable industries, and the lack of good surface drainage make the introduction of a complete sewerage system almost imperative. A large number of people, desiring modern conveniences, have put in baths and water closets and sewered same to any convenient place, cess-pools, the canal, private sewers, etc. A continuance of this practice is expensive to each individual; unsanitary and objectionable in the extreme, especially the carrying of house drainage to cess-pools; and inimical to the general welfare of the village by delaying the introduction of a general system.

When the court house and jail were constructed, in the eighties, a sewer was run from the same direct to the river. This sewer has since been extended and added to until it has spread over three or four squares in the central portion of the town, and some three or four hundred people are using same, not including the main school building and a hotel. These sewers are poorly constructed and are frequently stopping up from this reason and also from lack of flushing. This collection of drains formerly had two outlets to the river but one of these is nearly closed up now and most of the sewage is diverted to the lower outlet which discharges to the river in the back-water of a mill-dam which is opposite the lower end of the city. This prevents the sewage from getting away and during low water a nuisance is complained of. This partial sewerage of the town has worked against a general system as those provided for are selfish enough to fight against a system for their neighbors. The question of a general system has been voted upon twice and defeated each time by a small majority. If the present sewers are to continue in use they will require a general overhauling and the introduction of proper flushing facilities to prevent frequent trouble from stoppage.

Those desiring sewers are now trying to bring pressure to bear upon those unfriendly to same and to obtain funds for the introduction of a

system for the whole city. It is proposed to carry a trunk sewer south of the town and empty it into the river below the dam mentioned above. The question of a separate or combined system of sewers will depend upon whether purification will be required or not. If it is required now or will be in the near future, the separate system will be the best, but if it is not required the combined system will be more economical. If the separate system is put in the storm water can be carried direct to the river and the sewage carried below to the river until purification is required. If the combined system is installed, it might be advisable to permit storm overflows to be made to the river above the dam so as to reduce the size and cost of the trunk sewer leading south.

At the point of proposed discharge the river has a rock bottom covered in places with gravel and sand. The flow is broken by shallow riffles alternating with deep pools, into one of which it is proposed to lead the sewer. The drainage area of this point is 561 square miles, or about 93 per 1,000 of population of Sidney, which is ample to care for all the sewage and prevent a nuisance under ordinary circumstances.

It must be noted, however, that the canal system diverts much water from the Great Miami river above Sidney and during dry seasons might prevent enough water coming down to dispose of the sewage by dilution. No public water supplies are obtained from the Great Miami river so far as known.

I would respectfully recommend that our Board direct the Sidney board of health to permit no more sewer connections to be made to the present drains; that it is the sense of this Board that that practice is a positive menace to the future health of the city, for the reason that there is no arrangement made for regular and systematic flushing to a degree that meets well defined sanitary requirements; and that the citizens of Sidney be recommended to construct a general sewer system at as early a date as is practicable, in the interest of the general sanitary condition of the city.

The report was approved and a copy of it was sent to the board of health of Sidney, April 5th, with a letter advising that the recommendations in this report be carried out as soon as possible

REPORT ON THE INVESTIGATION OF A NUISANCE AT WAPAKONETA.

The board of health of Wapakoneta requested the State Board of Health to send a committee to meet with their board and advise as to steps that should be taken for the abatement of a nuisance caused by the accumulation of filth in the Auglaize river. Dr. W. C. Chapman was appointed a committee to investigate, and he reported as follows:

In compliance with request made by Dr. Gemmill, acting president, I visited Wapakoneta on July 31st and investigated the sewer system of that place. The local health board desires to abate a nuisance occasioned by the accumulation of filth in the Auglaize river coming from sewers opening directly into the river in close proximity to its business center.

Wapakoneta is a town of about four thousand inhabitants, is situated on the west bank of the Auglaize river, which at this point is a small sluggish water course, frequently nearly dry in summer. The principal street parallels the river, there being one row of the finest buildings backing upon its banks. Cess-pools, vaults and drains from these buildings carry sewage from them directly into the sluggish stream, or are allowed to empty themselves onto the bank to find way as may be possible to the water below. The main sewer from the court house, city building and many residences has its discharge immediately in the rear of the best buildings in the town. Other sewers carry filth from school houses, breweries, stables, etc., all discharging into the river in close proximity. The odor is noticeable anywhere and is especially bad in the territory bounded by the river banks. At a point above the bridge spanning the river at one of the main streets, the flow of water being obstructed, a large quantity of sewage has accumulated and is a nuisance to sight and smell. The citizens are anxious to remedy the existing condition. There seems to be but little opposition to the approval of plans to this end. The local health board is a unit in advocating the necessity for the work, but the county authorities are not active in pushing the work. The State Board is asked to assist by suggesting plans and urging the work as imperative. There are no towns or villages situated on the Auglaize river between Wapakoneta and Defiance, a distance of nearly seventy miles. There is one hamlet, Buckland, eight miles below Wapakoneta, but this is located some distance from the river and would not be injured by sewage that might be carried down from above.

After carefully considering the matter and understanding the feeling of the local board and a large majority of the citizens, I would recommend the following as a plan which can be carried out easily with a minimum of expense and will for some time to come be all that is necessary:

- 1st. A sewer should be built along the river front not less than 30 inches, possibly 36 or 40 inches in diameter, being fully a mile in length and made to discharge into the river at a point where there is sufficient depth and fall of water to assure of proper cleaning and free flow at all times.

- 2nd. All sewers now built and to be built, and all house drainage to be carried directly into this sewer by laterals or otherwise.

- 3rd. If at any time farmers, or others living below the place of discharge, make complaint that such discharge has become a nuisance, the

city must establish disposal works satisfactory to the State Board of Health.

4th. The city shall submit, for the consideration of the State Board of Health, such plans as may be adopted before beginning actual construction.

I would further state that the supply of water for all purposes is derived from wells drilled into gravel at the level of the river bed, not far distant from the point at which the river is polluted by sewage. From taste and smell and appearance I should not judge it good water.

Prompt action by the State Board of Health is urged so that a report may be made and plans presented at the next meeting.

This report was approved by the State Board, a copy was sent to the local health authorities at Wapakoneña, and they were urged to carry out the recommendations therein.

REPORT UPON THE SANITARY CONDITION OF THE GREENE COUNTY COURT HOUSE.

It was reported to the Board by the chief inspector of workshops and factories that having been called upon to examine into the condition of the court house of Greene county, he had found it not only unsafe, but in a bad sanitary condition. He requested that an examination of its sanitary condition be made by this Board. Dr. Byron Stanton was accordingly appointed a committee to examine the court house and report. The inspection was made on February 22nd, 1900, and a report submitted as follows:

The court house consists of two parts, the older, two stories high, built about 1842, and a newer part, of three stories, built about 1873. The older part is very much dilapidated, the front wall being badly cracked, the roof in bad condition and the cornice so much decayed that there is danger of portions of it falling at any time. The rooms of both the old and new parts are damp, the vaults in which the records are kept being especially so.

The building is heated by direct radiation, the steam for which is generated in an old boiler under the center of the building. No provision is made for ventilation in any part of the building, except such as can be had by opening the doors or windows, which must necessarily expose the occupants of the rooms to draughts of air. This defect cannot be remedied except by the construction of unsightly ventilating flues in the rooms, as the walls could not safely be excavated for ventilating flues.

Near the front of the old building, on the first floor, are the water closets, doors from which open directly into the main hall. The odors from these closets permeate the hall and the offices. The discharge from the closets is into a vault, or cess-pool, about 10 feet deep and at least as much in diameter, in the basement of the building. The vault is arched

over and covered with an iron cover. It is ventilated by a four-inch pipe running horizontally about 30 feet and then perpendicularly to the roof. So imperfect, however, is the ventilation that at all times odors from the vault fill the basement and must necessarily find their way to the rooms above. This vault has to be cleaned frequently, but at times has been neglected and overflow into the basement has occurred to add to the discomfort and danger of the place.

The grading of the ground about the building is such that storm water and melting snow find their way to the basement, keeping it at all times damp and unwholesome.

To remove all of the elements of unsafety and place the court house in proper condition would require the expenditure of a large sum of money, and, in my opinion, it would be the part of wisdom to tear down both buildings and erect a new one. In the event of not being able to secure this within a very few years, I would suggest that our Board unite with the local board of health in advising the county commissioners to at once carry out the following recommendations:

- (a). The removal of the cess-pool from under the building.
- (b). The adoption of some better system of ventilating the offices and vaults.
- (c). The prevention of inundations of the basement by better grading, or by putting the walls, windows and doors of the basement in better condition.
- (d). Immediate attention to the condition of the cornice and walls of the old building.

While not directly connected with the subject under my investigation, it has occurred to me that one great need of the city of Xenia is a good system of sewers. It is an old city and soil contamination has gone on to a dangerous extent and the most effective remedy is thorough sewerage of the city. I would therefore suggest that the local board of health be urged to use its utmost endeavors to bring this about.

A copy of this report was sent to the commissioners of Greene county and to the board of health of Xenia. The investigation proved helpful in securing prompt action on the part of the county commissioners looking towards the construction of a new court house

REPORT OF AN INVESTIGATION OF AN ALLEGED NUIS-
ANCE IN XENIA TOWNSHIP, GREENE COUNTY,
CAUSED BY THE SEWAGE OF THE
O. S. & S. O. HOME.

A complaint was made to the Board in regard to a nuisance created by the discharge of the unpurified sewage from the Soldiers' and Sailors' Orphans' Home into Shawnee creek, Xenia township, Greene county, was referred to Dr. Stanton and Mr. Flynn, engineer, as a committee for in-

vestigation. The committee visited the Home on January 31st, 1900, and in company with Dr. DeHaven, health officer of Xenia, Mr. Fulton, superintendent, and Mr. Evans, engineer of the Home, investigated the matter and made the following report:

This Home is situated along the line of the C. H. & D. R. R., one mile southeast of Xenia, on a farm of two hundred and ninety-six acres. This institution consists of 32 cottages, an administration building, two school houses, hospital and four hospital cottages, laundry, industrial building, power houses, store rooms, slaughter houses, and farm buildings, etc. In these buildings are accommodated 850 children and 160 officers, teachers and help. The place is supplied with its own water supply, gas and electric plants, heating plant and sewer system.

The latter is of piecemeal construction, having been added to and altered as the institution grew in size. Originally all the sewage was collected by a trunk sewer in the rear of the row of cottages and carried to a cess-pool dug down to the gravel and designed to dispose of the same through this porous stratum. This soon became inadequate and an overflow was made to a ditch which empties into Shawnee creek at the northwest corner of the grounds. As additions were made to the Home this method of disposal began to become a nuisance, and the following plan was adopted:

A 47,000-gallon water-tight cess-pool or cistern was constructed in the rear of the boiler house, into which all the sewage was to be collected and then pumped to beds or pools back on the farm, from which it was to be distributed over the fields by gravity. Just the amount of sewage diverted to the cess-pool is uncertain. The engineer claims that all liquid waste of every kind finds its way there, while the superintendent was of the opinion that the water from the baths, wash basins, etc., still followed the old course to Shawnee creek. One thing is certain, however, that to cause the old trunk sewer, carrying the bulk of the sewage, to flow to the new cess-pool, a gate on the old outlet must be kept closed and the sewage turned back into a new main leading to the pool in question. This main enters the cess-pool far enough below the top so that if the pool is not emptied by pumping, the sewage will rise to such a height that it will back up this same main and flow out at the point where the trunk sewer joins and down to the old cess-pool by the original route. This old cess-pool is now filled up and the sewage passes through it without any sedimentation whatever.

The pump to force the sewage from the new cess-pool back onto the farm was installed in 1895 and is a horizontal single action Laidlaw-Dunn-Gordon pump of 300,000 gallons capacity. Running at a speed of 22 revolutions per minute, the usual rate, it can pump about 185,000 gallons in 24 hours. This is much below the total amount of sewage as will be seen from a comparison with the water supply.

There are two kinds of water supplied to the institution, soft water from Shawnee creek for use in the boilers, lavatories, etc., and hard water from wells for domestic use. The soft water is pumped to two elevated tanks, by two horizontal, simple pumps, only one of which is in use at a time. One of these was made in Columbus and has a capacity of about 175,000 gallons, and the other is a Smith-Vaile, of Dayton, with a capacity of 250,000 gallons. The last named is the one in use and it pumps about 150,000 gallons daily. This water is used as above stated and for filling an artificial lake, so that all of it does not reach the sewers. The domestic supply is furnished by two horizontal simple pumps of the Knowles and Laidlaw-Dunn-Gordon makes respectively, and of 250,000 gallons capacity each. Only one of these pumps is in service at a time and the average daily amount pumped is 230,000 gallons, all of which finds its way to the sewers as sewage.

It is thus seen that the capacity of the sewage pump is much too small. It should be doubled at least and with duplicate pumps in addition for use when the first is out of order, a common occurrence with pumps handling sewage. The lift for the sewage is only 23 feet, and some more appropriate design than a piston pump could probably be found for this work.

The pools back on the farm to which sewage is pumped are four in number and consist of rough excavations about 50 feet long, 20 feet wide and 3 feet deep. From these the sewage was supposed to be spread out on the fields for disposal, but now one side has been cut through and the sewage allowed to flow direct to a small run which empties below Xenia. This same run also drains the slaughter house and farm buildings. A series of standpipes and nozzles are scattered over the farm near the beds from which the sewage was at one time spread by means of a hose. At the time of inspection only one bed was receiving any sewage and this but for a short time, as the pump had been out of order for 30 days.

Most of the sewage was following the old route through the first cess-pool and into Shawnee creek. The fact that much of the sewage was going direct to the creek prevented the solving of the question as to how much could be sent to the new cess-pool. This same pool was covered with a thick heavy scum and from all appearances had been disturbed but little by the entering sewage and the pumps.

It is the belief of your committee that the complaint is well founded and that the capacity of the sewage pumps should be so much increased so that all of the sewage can be used for irrigation or that provision should be made for its purification before its drainage into the creek. We would therefore recommend that the attention of the trustees of the Home be called to the matter and that they be urged to make early arrangements for abating a serious nuisance.

A copy of this report was sent to the Board of Trustees of the Home, with the request that some steps be taken to have the nuisance abated. Later, complaint was made that the nuisance was unabated and a request received that another investigation be made. Accordingly the same committee, namely Dr. Stanton and the engineer, visited the Home and reported as follows:

The committee visited the place Saturday, July 14, 1900, and found precisely the same conditions that were found by the same committee on an inspection made January 31, 1900; except that it being vacation time, when less than one-third of the usual number of persons were in the institution, the amount of sewage to be disposed of is so much less than the usual flow that the capacity of the sewage pump is sufficient to dispose of the sewage by pumping it to a ravine in the rear of the institution, whence it finds its way to the Little Miami river some distance below Xenia. When the institution is full the sewage pump cannot dispose of all of the sewage and more or less of it must find its way to Shawnee creek, where it will again occasion a serious nuisance.

Part of the sewage was flowing direct to Shawnee creek, but the quantity was not large, as the sewage pump was working at the rate of 42 revolutions per minute, two revolutions above the maximum mean of the pump. If this rate was kept up for twenty-four hours, 348,000 gallons of sewage would be pumped to the beds back of the institution. This quantity is slightly in excess of the amount supplied at present and thus no sewage need be sent to Shawnee creek, but the rate of pumping can hardly be maintained continually and at times it must be necessary to allow some sewage to flow to the creek.

The sewage pump was discharging into two beds through which the sewage passed direct to a small run which empties into the Miami river below Xenia. These beds offer no chance, as operated, for either the purification or even the sedimentation of the sewage, and it would be as well to pump the sewage direct to the stream. The reason for lack of complaint from sending sewage to this stream is that a gardener below uses its water for irrigation purposes and so has no objection to the sewage.

The small amount of sewage flowing to the creek at the time of inspection was due to the imperfect manner of shutting off the overflow from the main sewer. As explained in the first report, all the sewage was formerly sent to the creek, but it caused such a nuisance that it was diverted to a large cess-pool back of the boiler house from which it was to be pumped to the disposal beds. To keep the sewage from flowing by the original route to the creek an iron plate was arranged so that it could be shoved down over the inlet. All this is under ground and can only be reached by digging, and as would be expected the cut-off is not complete. This should all be dug up and a man hole placed at the junction in which a proper gate should be placed so that the sewage could be completely cut off from the creek, or the old outlet should be closed up altogether.

Attention is again called to the fact that the sewage pump is entirely inadequate to handle the sewage and some of it must of necessity be sent to Shawnee creek, except perhaps for a short time when the amount of sewage is within the extreme capacity of the pump.

The committee therefore repeats the recommendation made in the former report, that the attention of the trustees of the Home be called to the matter, and that they be urged to take immediate steps to remove this menace to the health and comfort of those living along Shawnee creek. In case of their failure to do so, there would seem to be no other way but for the local health authorities to resort to legal measures and enjoin the pollution of the Shawnee above the city of Xenia.

The question as to what steps could be taken for the abatement of this nuisance was referred to the attorney-general, Hon. J. M. Sheets, from whom the following reply was received:

"The question submitted by you in your communication of July 27th is as to what steps can be taken by the State Board of Health, the township or city board of health, towards abating a nuisance caused by the discharge of sewage from the O. S. & S. O. Home, situated in Xenia township, Greene county, Ohio, where the trustees of that institution, after due notice, neglect or refuse to take the proper steps to abate the same.

"The nuisance referred to in your letter being located outside the city of Xenia, it falls under the jurisdiction of the township board of health. Section 2121 R. S.

"The State Board of Health has no jurisdiction in such cases except 'When emergency exists and the local board of health has neglected or refused to act with sufficient promptness or efficiency.' Section 409-25 R. S. But, as no emergency is claimed to exist and no complaint that the local board of health is not ready and willing to act promptly, the State Board is without jurisdiction.

"But what can the township board do, is the question? Section 2128 R. S. provides: 'When any building, erection, excavation, premises, business, pursuit, matter or things, or the sewerage, drainage, plumbing or ventilation thereof is, in the opinion of the board of health, in a condition dangerous to life or health, and when any building or structure is occupied or rented for living or business purposes, and sanitary plumbing and sewerage are feasible and necessary, but neglected or refused, the board of health may declare the same a public nuisance, and may order the same to be removed, abated, suspended, altered, or otherwise improved or purified, by the owner, agent or other person or persons having control of the same, or being responsible for the condition; and the refusal or neglect to obey said order shall be a misdemeanor, punishable as hereinafter provided. The board may also, by its officers and employes, remove, abate, suspend, alter or otherwise improve or purify the same, and certify the cost and expense thereof to the county auditor, to be assessed against the property, and thereby made a lien upon the same, and collected as other taxes.'

" This, however, being a state institution, the board of health cannot abate the nuisance and certify the costs to the county auditor to be collected by him as taxes

" Hence, I know of no remedy unless it be to proceed against the trustees of the institution, or others having that matter in charge, by criminal proceedings. This proceedings, however, would not abate the nuisance."

The attention of the Board of Trustees of the Home was again called to this nuisance and the following communication from the Hon. John S. Jones, President of the Board, will show the action taken by that Board:

" I am directed by the Board of Trustees of the Ohio Soldiers' and Sailors' Orphans' Home to acknowledge the receipt of your communication of date August 8, 1900, calling attention to a complaint which had been made to the State Board of Health of a nuisance caused by the discharge of the sewage from our institution into Shawnee creek and that you enclose a copy of the report made by a committee of your Board of its investigation and asking that steps be taken to remove the same. Also that the attention of your board was again called to the matter and a second investigation made, etc., and enclosing copy of report, etc.

" We desire to say that the copy of the first report on this subject made by your committee February 5, 1900, to your Board was submitted by us to the Committee on Finance of the House of Representatives of the General Assembly of Ohio and an appropriation requested verbally and in writing for the sum of sixteen hundred dollars (\$1,600) to be used in abating the nuisance referred to. We quote from the written application furnished said committee on appropriations with copy of report of your committee the following extract:

" ' Our attention has been called to a communication from the Secretary of the State Board of Health to the necessity of providing for abating a nuisance caused by the discharge of sewage from the Home. To abate the nuisance will require an expenditure for purchase of 2,250 feet five inch pipe and and duplicate sleeves for pumps to use when accident occurs which will cost at least sixteen hundred (\$1,600) dollars, and we ask an appropriation for this purpose.'

We used every reasonable effort to secure such an appropriation. No appropriation, however, was made. We have used precautions to prevent a recurrence of the grievance with commendable success. However this may be we are prosecuting investigations through our engineer, Fred. W. Ballard, recently appointed, and whose intelligent reports on this matter, made to us, indicate that he "knows his business," and we expect to be able to control our sewage in such manner as to prevent any discharge whatever into Shawnee run.

We have taken steps to thoroughly test the capacity of our system and if not large enough we hope to be able to enlarge it so as to handle

the sewage of the Home in such manner as will be satisfactory to ourselves and satisfactory to our neighbors. We hope to be able to do this with the means at our command, but if we are unable to do this we shall continue to use every effort to secure the necessary means at the earliest practicable moment. We are improving our beds (three in number) for the purification and sedimentation of the sewage and are considering other methods in case these do not prove efficient when put in proper condition.

We do not expect to relax our efforts until we find a complete and satisfactory solution, that will remove all just cause of complaint."

EXAMINATIONS

MADE IN THE

LABORATORY

OF THE

Ohio State Board of Health

During the Year 1900.

WORK OF THE LABORATORY.

As stated in another part of this report, the investigation of streams and public water supplies in which the Board has been engaged for several years has required most of the time of the laboratory force. Nevertheless, all examinations requested by local health authorities have been made, and as promptly as possible. Most of these requests have been for examinations of well waters suspected to have caused typhoid fever. A number of examinations were made for suspected diphtheria. The demands for these have not been as numerous as was expected. It is probably true, as held by most of our physicians, that the great majority of diphtheria cases can be recognized clinically, and without the aid of bacteriological examination. The fact that the diphtheria bacillus is occasionally found in healthy throats has left a doubt in minds of some as to the value of such examinations. It is certainly true, however, that it is not always possible to recognize the disease, and health authorities are most cordially invited to make use of the laboratory in all doubtful cases. No charge is made for any examinations made upon the request of local boards of health.

New laboratory quarters have been provided in the addition to the State House, which, it is expected, will soon be ready for occupancy. These will offer much better facilities for the work.

The total number of examinations made in the laboratory during the year 1900 was 1482.

The expenses during the year were:

Salaries	\$2,165 00
Traveling expenses	424 18
Supplies	317 58
Rent	180 00
Janitor	120 00
Total	<u>\$3,206 76</u>

DIPHTHERIA EXAMINATIONS.

Case number.	Place.	Rec'd			Patients.			Physician's Diagnosis.	Membrane present.	Day of disease.	Result.	Remarks.
		Month.	Day.	Age.	Sex.	Color.	Temp.					
45	Cambridge.....	10	17	7	F.	White	98.6	Diphtheria.....	No		+	
47	Dudley.....	8	11	5	F.	White	98.5	Diphtheria.....	Yes		+	Mild tonsillitis weeks ago.
36	Geneva.....	1	4	35	M.	White	102.0	Tonsillitis.....	Yes		+	Sister to No. 51.
51	Highland.....	11	13	5	M.	White	a	"	Yes		+	Discharge from nose.
52	"	11	13	3	F.	White	a	"	No	45(?)	+	Sister died day before croup (?)
53	"	11	13	3	F.	White	a	"	No	10	+	Specimen improperly taken. Examination
54	"	11	13	16	M.	White	a	Follicular tonsillitis.....	Yes(?)	4	+	was unsatisfactory.
55	Hillsboro.....	11	14	9	M.	White	98.4	Diphtheria.....	— (?)		+	
58	"	11	15	4	M.	White	a	"	No		+	
59	"	11	17	4	F.	White	normal	"	No		+	
60	"	11	19	5	F.	White	100.0	"	No		+	
61	"	11	21	7	F.	White	102.0	"	No	1	+	
62	"	11	21	9	M.	White	98.8	"	Yes	1	+	
64	"	11	22	2	M.	White	normal	Membranous croup.....	No	1/2	+	
65	"	11	23	3	F.	.....	102.0	"	No	a	+	
66	"	11	30	9	M.	White	normal	Diphtheria.....	Yes		+	
67	"	11	30	12	M.	White	99.2	Suspicious.....	Yes	1	+	
68	"	12	5	6	M.	White	102.2	Follicular tonsillitis (?).....	Yes	2	+	
69	"	12	6	3	M.	White	100.0	"	a		+	
70	"	12	7	6	F.	White	103.0	"	No	2	+	
71	"	12	10	19	F.	White	99.4	Diphtheria.....	Yes	2	+	
72	"	12	10	7	F.	White	98.6	"	No	2	+	Patient recovering from typhoid fever.
73	"	12	12	2	F.	White	102.0	Follicular tonsillitis, diph. (?).....	No	1	+	
74	"	12	26	3	M.	White	sub-norm ¹	Diphtheria.....	Yes	1	+	
75	"	12	26	9	M.	White	101.0	"	No	1	+	
76	"	12	27	9	M.	White	a	"	Yes	a	+	Specimen consisted of trachea and larynx of corpse.
42	Kelly's Island.....	3	16	3	F.	White	sub-norm ¹	Diphtheria.....	Yes		+	
40	Lisbon.....	1	20	3	F.	White	to 102.8	"	Yes	8	+	
41	"	5	3	27	F.	White	101.6	"	Yes	10	+	
48	Minster.....	11	1	5	M.	White	101.4	"	Yes	2	+	
49	"	11	1	4	M.	White	normal	"	Yes	3	+	
63	Mowbrystown.....	11	1	5	M.	White	102.0	Membranous laryngitis.....	Yes	3	+	
50	Mt. Sterling.....	11	22	8	F.	White	101.0	Diphtheria.....	Yes	3	+	
46	New Albany.....	11	5	12	F.	White	a	"	a	a	+	Specimen was piece of membrane
38	North Lewisburg.....	9	1	3	a	a	a	"	a	a	+	"
39	"	1	8	a	a	a	a	"	Yes	a	+	"

DIPHTHERIA EXAMINATIONS — Concluded.

Case number.	Place.	Rec'd		Patients.				Physician's Diagnosis.	Membrane present.	Days of disease.	Result.	Remarks.
		Month.	Day.	Age.	Sex.	Color.	Temp-erature.					
35	South Bloomfield....	1	4	9	a	White	101.0	Follicular tonsillitis.....	Yes			
37	"	1	6	32	M.	White	a	Tonsillitis	a	2	+	
74	"	12	14	a	a	a	a	"	Yes	7	+	
56	South Charleston...	11	15	5	M.	White	99.8 to 103.0	Diphtheria.....	Yes	4	+	Swab was in unsatisfactory condition.
57	"	11	15	3	F.	Black	102.0	"	Yes	5	+	Child died January 18. Corpse disinterred
41	Tiffin	1	25	2	M.	White	a	Non-spasmodic croup... ..	Yes		+	and trachea sent to laboratory.
43	Vermillion.....	5	11	27	F.	White	102.5	Supposed diphtheria.....	Yes	2	+	

42 examinations; 35 positive.

— Diphtheria bacilli not found.

+ Positive diagnosis.

a Unreported.

MISCELLANEOUS EXAMINATIONS.

Case number.	Place.	No. of samples.	Nature of sample.	Examined for	Remarks.
6 T...	Columbus Grove.	1	Sputum	Tubercle bacilli	Negative
53....	Croton	1	Meat	Trichina	Negative
58....	Dresden	1	Dog	Rabies	Positive
54....	Hamilton	1	Ice	Pollution	Polluted
52....	Princeton	1	Urine	Cast and Al- bumen	Positive
56....	Rehobeth	28	Waters	Chlorine test..	.....
55....	Scott	1	Material from a well.....	Character	Grease
7 T...	Hiro	1	Sputum .....	.....	Negative
57....	Versailles	11	Water	Chlorine test..	In connection with propos- ed supply....

Total — 46 samples, with 49 examinations.

WATER ANALYSES.

PROPOSED PUBLIC WATER SUPPLIES.

During the year 1900, samples of water have been examined from sources proposed as public water supplies or as additions to existing supplies in twelve cities and villages as follows:

Place.	No. of samples.	Source of Samples.
Canton	4	Wells, driven 3, drilled 1.
Cuyahoga Falls	5	Wells, drilled 2, dug 2; Spring, 1.
Dayton	3	Wells, drilled.
Fort Recovery	2	Wells, drilled.
Gallipolis	2	Wells, drilled.
Geneva	2	Grand River; Lake Erie.
Glouster	1	Well, dug.
Leetonia	1	Well, drilled.
Leipsic	1	Well, drilled.
Lynchburg	1	Spring.
Versailles	5	Wells, drilled.
Waynesville	1	Well, drilled.
Total	28	

The analytical results for the foregoing samples will be found under the name of the village or city in the section devoted to reports on proposed public water supplies. Those supplies acted upon since October 31, 1900, will appear in the annual report for 1901, as that portion of the report, in compliance with law, is for the year ending October 31.

EXISTING PUBLIC WATER SUPPLIES.

During the year samples of water have been examined from the following cities and villages in connection with the present public water supplies of those places:

WATER SUPPLY OF BATAVIA.

The source of supply is East Fork of Little Miami river, and the water is treated by a mechanical filter. This is a new supply and the details of the plant may be found on page 57, under the Report on Proposed Water Supply for Batavia. The character of the river water in the neighborhood of the intake pipe is shown by the samples from "Batavia, above town," for which see appendix to this volume.

In connection with the monthly study of the Little Miami river, in October the bacteriologist of the Board started to test the bacterial efficiency of the filter at Batavia water works, but only two samples had been taken of the effluent when the test was interrupted by the stopping to the filter to make some adjustments. The filter had been in operation but two days, and had not been fully adjusted. At the time of the November river investigations the filter was not in operation, as the demand for water was small and the "clear well" was full.

BACTERIOLOGICAL EXAMINATIONS OF FILTERED AND UNFILTERED WATER AT BATAVIA.

Number.	Date of collection.	Source.	No. of bacteria per c. c.
	1900.		
1440.....	October 19.....	Filter effluent.....	400
1441.....	October 19.....	East Fork Little Miami river .	4,900
1442.....	October 19.....	Filter effluent.....	450
1443.....	October 19.....	East Fork Little Miami river..	5,400

These initial tests showed a reduction of 4,725 bacteria per c. c. or an efficiency of 91.75 per cent. This examination of course could not be taken as conclusive of the ability of the filter, in view of the fact that the plant was hardly completed, and not in regular running order.

WATER SUPPLY OF BELLEVUE.

The sources of supply are a deep well and two impounding reservoirs fed by a county ditch. See annual report for 1898, page 574.

At the request of the local board of health, examination was made of a sample of water taken from a hydrant in the town, and said to be a mixture of the well and reservoir waters. The analysis would indicate the sample was chiefly from the reservoirs.

CHEMICAL EXAMINATION OF WATER FROM BELLEVUE.

PARTS PER MILLION.

Number.	Date collected.	Appearance			Nitrogen as			
		Sediment.	Turbidity.	Color.	Albuminoid ammonia.	Free ammonia.	Nitrites.	Nitrates.
1195... ..	1900 June 25	trace	trace	.15	.133	.013	.001	1.62

Oxygen required.	Chlorine.	Alkalinity.	Incrusting constituents.	Residue on evaporation.	
				Total.	Loss on ignition.
3 62	.7	106 0	26	237	81.

The sample had a vegetative odor.

WATER SUPPLY OF CANTON.

The sources of supply have been a number of wells (averaging 270 feet in depth) and the West Branch of Nimishillen creek. See annual report for 1898, page 576. To overcome the necessity of using the creek water, new wells were sought for as an addition to the supply. See report on Canton's proposed additional supply, this volume. At the request of the water works trustees examinations were made of samples of water from two of the newer wells.

CHEMICAL EXAMINATION OF WATER FROM CANTON

PARTS PER MILLION.

Number.	Date collected.	Appearance			Nitrogen as			
		Sediment.	Turbidity.	Color.	Albuminoid ammonia.	Free ammonia.	Nitrites.	Nitrates.
1424.....	Oct. 11	none	none	none	.037	.256	.001	.66
1425.	Oct. 11	none	none	trace	.019	.067	trace	none

Oxygen required.	Chlorine.	Alkalinity.	Incrusting constituents.	Residue on evaporation.	
				Total.	Loss on ignition.
.60	9.7	238.8	none	311	58.
.48	.3	216.8	none	270	76.

Both samples were odorless. The first sample was from a drilled well 200 feet deep and located one mile north of the pumping station; the second was from a driven well on Navarre street, 50 feet deep.

WATER SUPPLY OF COLUMBUS.

For a full description of the water supply see annual report of State Board of Health for 1898, page 578. Water for the public supply is derived from driven wells, filter basins, filter galleries, and the Scioto river.

BACTERIOLOGICAL EXAMINATIONS OF COLUMBUS WATER FROM FAUCET IN
LABORATORY OF STATE BOARD OF HEALTH.

Sample number.	Date collected.	Hour.	Appearance of sample.	No of bacteria per c. c.	Remarks.
889	January 2	11.00 a. m.	Clear	500	
890	" 3	11.00 a. m.	"	475	
891	" 4	1.00 p. m.	"	400	
892	" 4	10.00 a. m.	"	350	
893	" 6	12.00 n.	"	350	
894	" 8	5.00 p. m.	"	550	
895	" 9	9.00 a. m.	"	400	
896	" 10	8.00 a. m.	"	350	
897	" 11	1.00 p. m.	"	350	
898	" 12	12.00 n.	"	3,600	
899	" 13	2.00 p. m.	Faint roilly	10,100	
900	" 15	12.00 n.	"	10,700	
902	" 16	9.00 a. m.	"	11,200	
903	" 17	9.00 a. m.	"	7,900	Chemical analysis.
904	" 18	9.00 a. m.	"	4,900	
905	" 19	12.00 n.	"	2,500	
906	" 20	11.00 a. m.	"	11,400	
907	" 22	1.00 p. m.	"	4,900	
908	" 23	4.00 p. m.	"	3,100	
909	" 24	11.30 a. m.	Faint hazy	3,000	
910	" 25	9.30 a. m.	Clear	2,100	
911	" 26	12.00 n.	Faint hazy	2,900	
914	" 27	1.30 p. m.	"	2,800	
915	" 29	8.30 a. m.	Nearly clear	1,400	
916	" 30	8.00 a. m.	"	2,300	
917	" 31	9.00 a. m.	"	550	
918	February 1	8.00 a. m.	"	1,000	
919	" 2	8.30 a. m.	"	840	
920	" 3	8.30 a. m.	"	600	
921	" 5	9.30 a. m.	Clear	330	
922	" 6	11.00 a. m.	"	750	
923	" 7	4.00 p. m.	"	475	
924	" 8	9.00 a. m.	"	400	
925	" 9	1.00 p. m.	Faint hazy	3,000	
926	" 10	1.00 p. m.	"	2,800	
927	" 12	4.00 p. m.	Faint cloudy	7,600	
929	" 13	2.00 p. m.	"	2,900	
940	" 14	11.00 a. m.	Cloudy	5,100	
941	" 15	11.00 a. m.	Faint roilly	7,300	
942	" 16	1.00 p. m.	"	4,400	
945	" 17	9.00 a. m.	"	5,100	
946	" 19	10.00 a. m.	Faint clear	2,500	
947	" 20	12.00 n.	Nearly clear	750	
950	" 21	9.00 a. m.	"	900	
951	" 22	9.30 a. m.	"	2,200	
952	" 23	9.00 a. m.	"	2,600	
953	" 24	8.00 a. m.	Faint roilly	10,300	
954	" 26	1.00 p. m.	Faint cloudy	6,900	
955	" 27	9.00 a. m.	"	6,100	
956	" 28	1.00 p. m.	"	3,800	
957	March 1	4.30 p. m.	Nearly clear	2,700	
958	" 2	3.30 p. m.	"	5,800	
959	" 3	1.00 p. m.	"	3,400	
964	" 5	9.45 a. m.	Faint roilly	6,400	Chemical analysis.
969	" 6	9.20 a. m.	Faint cloudy	7,300	
974	" 7	9.00 a. m.	Cloudy	6,900	
977	" 8	9.00 a. m.	"	3,500	
978	" 9	2.00 p. m.	Hazy	6,100	
979	" 10	11.00 a. m.	Faint hazy	2,600	
980	" 12	4.00 p. m.	Clear	1,400	
981	" 13	4.00 p. m.	"	850	
982	" 14	10.00 a. m.	"	550	
983	" 15	10.00 a. m.	"	1,000	
984	" 16	1.00 p. m.	Faint hazy	1,200	
985	" 17	10.00 a. m.	"	950	
988	" 19	8.30 a. m.	"	1,100	
989	" 20	3.00 p. m.	Nearly clear	1,800	
990	" 21	10.30 a. m.	"	1,000	
991	" 22	2.00 p. m.	"	1,300	
992	" 23	1.00 p. m.	Clear	450	
993	" 24	7.30 a. m.	"	550	
995	" 26	8.00 a. m.	Nearly clear	2,100	
996	" 27	7.30 a. m.	Clear	350	

COLUMBUS WATER—Continued.

Sample number.	Date collected.	Hour.	Appearance of sample.	No. of bacteria per c. c.	Remarks.
997	March 23.....	8.30 a. m.	Clear	600	
998	" 29.....	12.00 n.	"	600	
999	" 30.....	11.30 a. m.	"	1,000	
1000	" 31.....	10.00 a. m.	"	2,100	
1001	April 2.....	10.00 a. m.	Hazy	11,300	
1002	" 3.....	2.00 p. m.	Clear	2,600	
1003	" 4.....	2.00 p. m.	"	3,000	
1004	" 5.....	4.00 p. m.	Quite hazy	4,700	
1005	" 6.....	3.30 p. m.	Hazy	2,100	
1006	" 7.....	8.30 a. m.	"	1,900	
1009	" 9.....	2.00 p. m.	"	400	Chemical analysis
1010	" 10.....	10.00 a. m.	Cloudy	750	
1038	" 13.....	10.00 a. m.	"	350	
1055	" 19.....	3.30 p. m.	Hazy	8,200	
1056	" 20.....	8.00 a. m.	"	8,300	
1061	" 23.....	3.00 p. m.	Faint cloudy	3,100	
1076	" 27.....	1.00 p. m.	Hazy	1,600	
1077	" 28.....	9.00 a. m.	Nearly clear	1,000	
1078	" 30.....	10.00 a. m.	Clear	900	
1079	May 1.....	9.00 a. m.	"	1,500	
1080	" 2.....	9.00 a. m.	Nearly clear	1,000	
1085	" 3.....	8.30 a. m.	"	700	
1088	" 4.....	11.00 a. m.	Clear	600	
1089	" 5.....	9.00 a. m.	"	550	
1090	" 7.....	10.00 a. m.	Nearly clear	1,500	
1091	" 8.....	12.00 n.	"	1,200	
1092	" 9.....	4.00 p. m.	"	2,500	
1093	" 10.....	3.00 p. m.	"	1,800	
1094	" 11.....	10.00 a. m.	Clear	1,200	
1095	" 14.....	10.30 a. m.	"	1,700	
1096	" 16.....	3.00 p. m.	"	450	
1104	" 17.....	2.00 p. m.	Nearly clear	550	
1105	" 18.....	9.00 a. m.	"	800	
1106	" 21.....	11.00 a. m.	Clear	950	
1138	June 1.....	11.00 a. m.	"	1,200	
1139	" 4.....	9.00 a. m.	"	600	
1140	" 5.....	10.00 a. m.	"	550	
1141	" 6.....	10.00 a. m.	"	750	
1142	" 7.....	11.00 a. m.	"	700	
1143	" 8.....	2.00 p. m.	"	500	
1144	" 9.....	10.00 a. m.	Nearly clear	1,200	
1170	" 15.....	10.00 a. m.	Clear	500	
1171	" 16.....	2.00 p. m.	"	650	
1190	" 21.....	10.30 a. m.	"	700	
1193	" 22.....	4.00 p. m.	"	800	
1194	" 25.....	9.00 a. m.	"	425	
1204	" 29.....	9.00 a. m.	"	1,000	
1209	July 2.....	10.00 a. m.	"	1,100	
1210	" 3.....	1.00 p. m.	"	450	
1211	" 5.....	10.00 a. m.	"	650	
1212	" 6.....	10.00 a. m.	"	1,000	
1226	" 12.....	11.00 a. m.	"	950	
1232	" 13.....	11.00 a. m.	"	750	
1250	" 24.....	4.00 p. m.	"	2,000	
1251	" 25.....	10.00 a. m.	Cloudy	6,600	
1252	" 26.....	9.30 a. m.	"	1,700	
1253	" 27.....	9.30 a. m.	"	1,300	
1254	" 28.....	8.45 a. m.	"	1,300	
1255	" 30.....	3.00 p. m.	"	5,000	
1256	" 31.....	11.00 a. m.	"	6,800	
1258	August 1.....	3.00 p. m.	Faint cloudy	3,800	
1259	" 2.....	3.00 p. m.	"	2,500	
1260	" 3.....	1.30 p. m.	"	1,200	
1261	" 6.....	8.30 a. m.	Nearly clear	950	
1282	" 10.....	1.30 p. m.	"	350	
1283	" 14.....	11.30 a. m.	"	600	
1284	" 15.....	1.30 p. m.	"	700	
1286	" 16.....	10.00 a. m.	Faint cloudy	1,700	
1287	" 17.....	3.00 p. m.	Nearly clear	1,200	
1312	" 23.....	2.00 p. m.	"	2,000	
1313	" 24.....	3.00 p. m.	"	550	
1314	" 25.....	9.00 a. m.	"	1,700	
1315	" 26.....	2.00 p. m.	Hazy	550	
1316	" 27.....	2.30 p. m.	Faint cloudy	900	
1319	" 28.....	4.00 p. m.	Nearly clear	1,100	

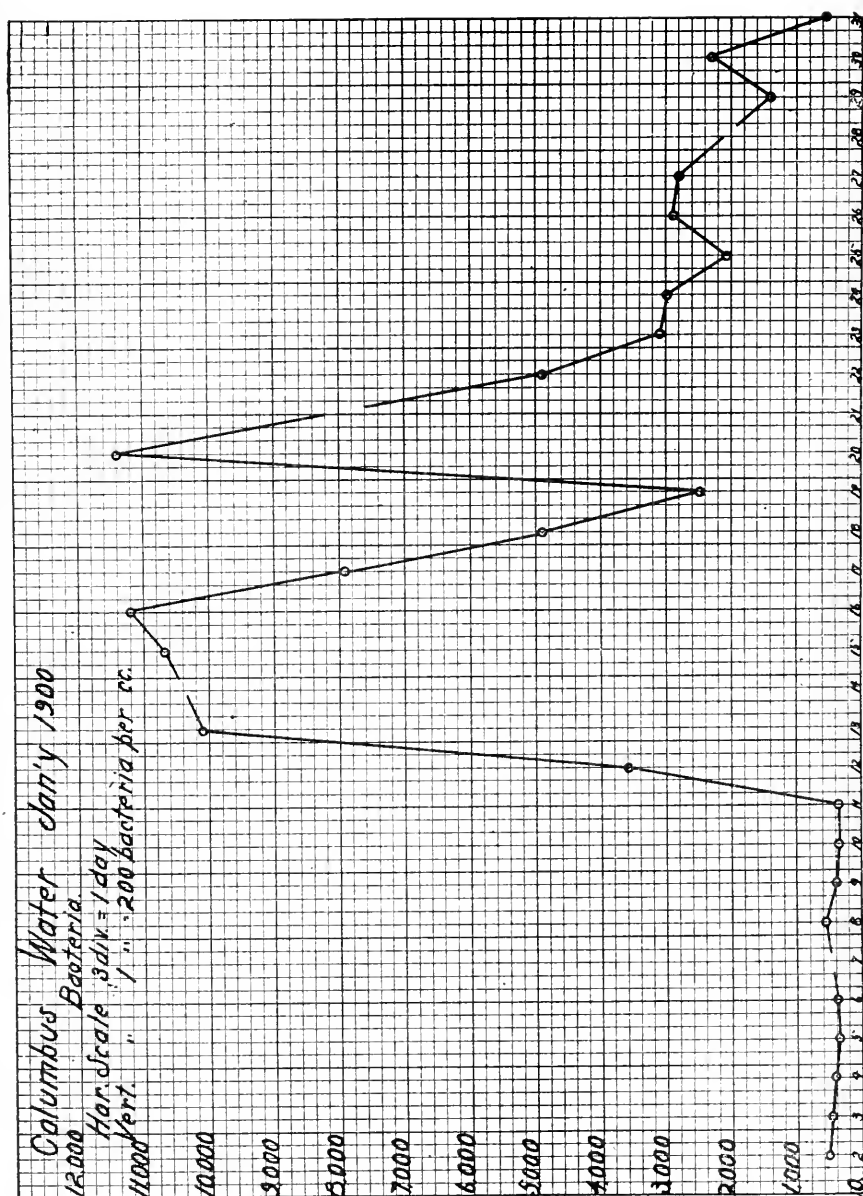
COLUMBUS WATER—Concluded.

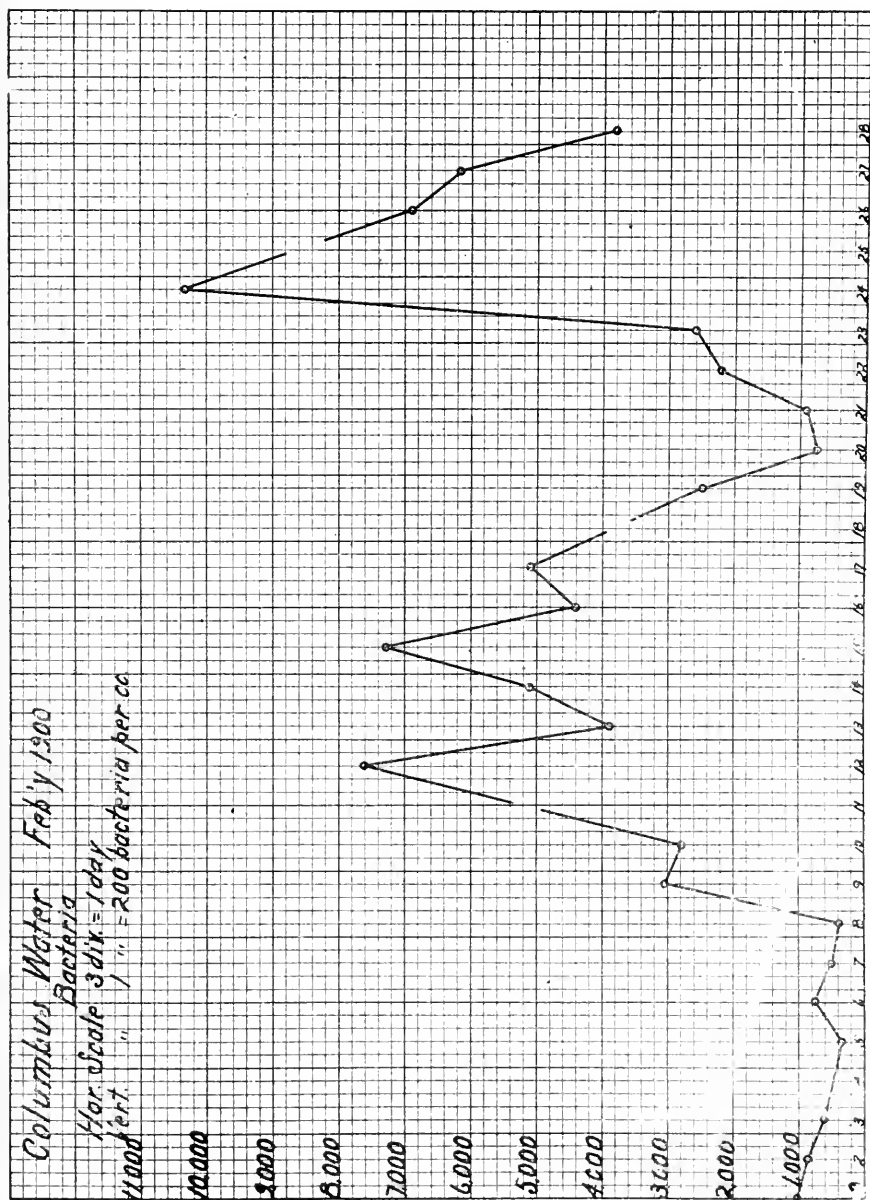
Sample number.	Date collected.	Hour.	Appearance of sample.	No. of bacteria per c. c.	Remarks.
1320	August 29.....	7.15 a. m.	Cloudy	1,100	{ Collected at 748 Neil Ave. Chemical analysis. Colon bacilli present.
1322	" 30.....	2.00 p. m.	"	1,000	
1346	Sept. 10.....	4.00 p. m.	Faint cloudy	1,000	Chemical analysis.
1349	" 11.....	3.00 p. m.	"	700	
1350	" 12.....	4.00 p. m.	"	1,400	
1352	" 13.....	9.00 a. m.	"	1,400	
1356	" 14.....	3.00 p. m.	"	900	
1357	" 15.....	2.00 p. m.	Cloudy	750	
1375	" 20.....	9.45 a. m.	Faint cloudy	1,000	
1376	" 21.....	10.15 a. m.	"	1,600	
1380	" 22.....	2.30 p. m.	"	800	
1382	" 23.....	11.00 a. m.	Cloudy	1,000	
1383	" 26.....	11.00 a. m.	Faint cloudy	3,400	
1385	" 27.....	3.00 p. m.	"	2,000	
1386	" 28.....	2.00 p. m.	"	1,600	
1409	Oct. 4.....	10.00 a. m.	"	550	
1412	" 6.....	9.00 a. m.	Cloudy	750	
1448	" 25.....	2.30 p. m.	Hazy	750	
1449	" 26.....	2.00 p. m.	"	800	
1451	" 27.....	1.00 p. m.	"	1,200	
1452	" 29.....	11.00 a. m.	Faint hazy	550	{ Raining lately. Chemical analysis.
1453	" 30.....	9.00 a. m.	"	800	
1456	" 31.....	5.00 p. m.	Nearly clear	1,200	
1479	Nov. 3.....	5.00 p. m.	"	750	
1504	" 15.....	1.00 p. m.	"	400	
1509	" 16.....	1.00 p. m.	"	300	
1510	" 17.....	2.00 p. m.	"	425	
1511	" 20.....	9.00 a. m.	"	450	
1512	" 21.....	10.00 a. m.	"	800	
1514	" 22.....	10.00 a. m.	"	450	
1516	" 23.....	2.30 p. m.	Clear	556	
1517	" 24.....	9.30 a. m.	Hazy	500	
1519	" 26.....	12.00 n.	Cloudy	7,600	
1521	" 27.....	11.30 a. m.	"	9,300	
1525	" 28.....	11.30 a. m.	Hazy	4,800	
1526	" 29.....	11.00 a. m.	"	4,300	
1527	" 30.....	3.00 p. m.	"	2,100	
1528	Dec. 1.....	11.30 a. m.	"	1,900	{ Chemical analysis. Colon not found.
1533	" 4.....	3.00 p. m.	"	550	
1534	" 5.....	2.00 p. m.	"	650	
1535	" 6.....	3.00 p. m.	Clear	375	
1536	" 8.....	10.00 a. m.	"	650	
1538	" 10.....	3.00 p. m.	"	600	
1540	" 11.....	2.30 p. m.	"	350	
1541	" 13.....	2.00 p. m.	"	900	
1542	" 14.....	11.00 a. m.	"	450	
1543	" 15.....	8.30 a. m.	"	375	
1544	" 17.....	9.45 a. m.	Nearly clear	1,200	
1545	" 18.....	3.00 p. m.	Clear	1,000	
1551	" 20.....	10.00 a. m.	Hazy	1,300	
1552	" 21.....	4.00 p. m.	Clear	800	
1553	" 22.....	11.30 a. m.	"	275	
1554	" 24.....	10.00 a. m.	Nearly clear	450	
1556	" 26.....	3.00 p. m.	Clear	800	
1557	" 27.....	4.00 p. m.	"	350	
1558	" 28.....	11.00 a. m.	"	400	
1559	" 29.....	10.00 a. m.	"	350	

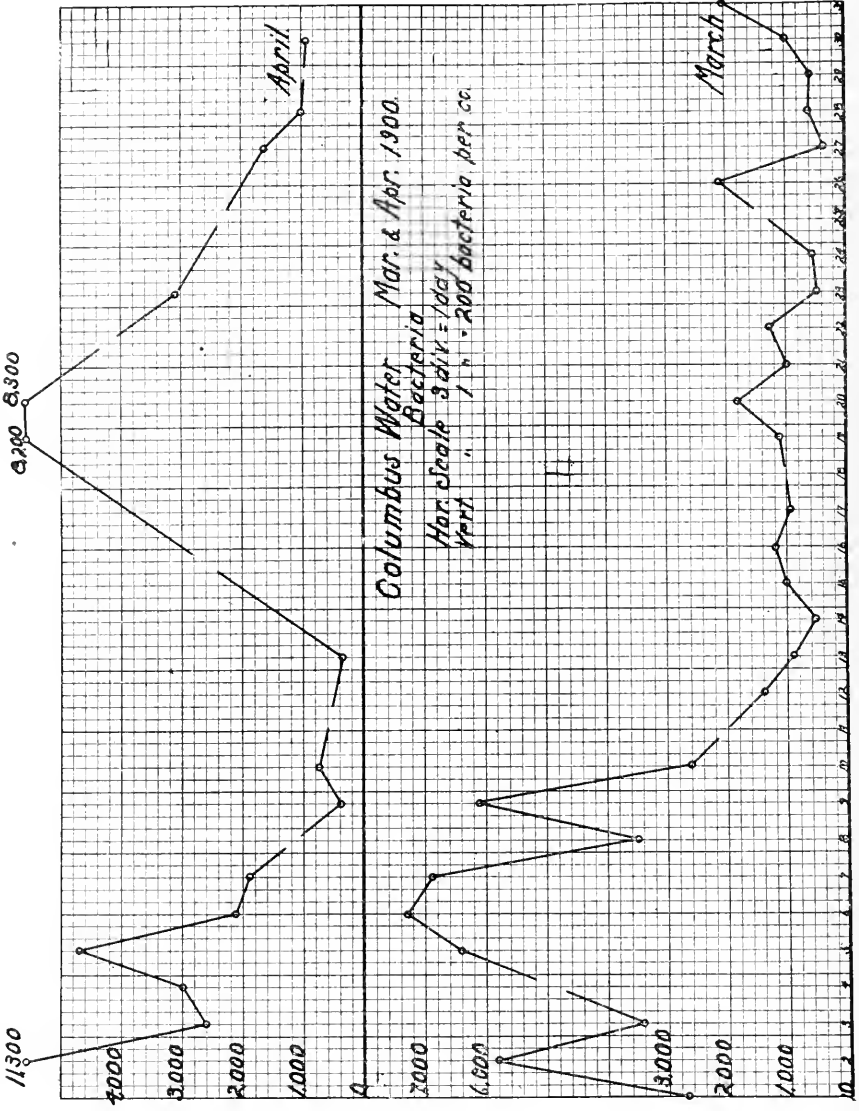
From the above analyses we obtain the following table of bacterial findings for the Columbus water as delivered from a faucet in the laboratory of the State Board of Health during 1900. The average number of bacteria for each month is represented by the mathematical average of the number of bacteria found on those days of the month that analyses were made.

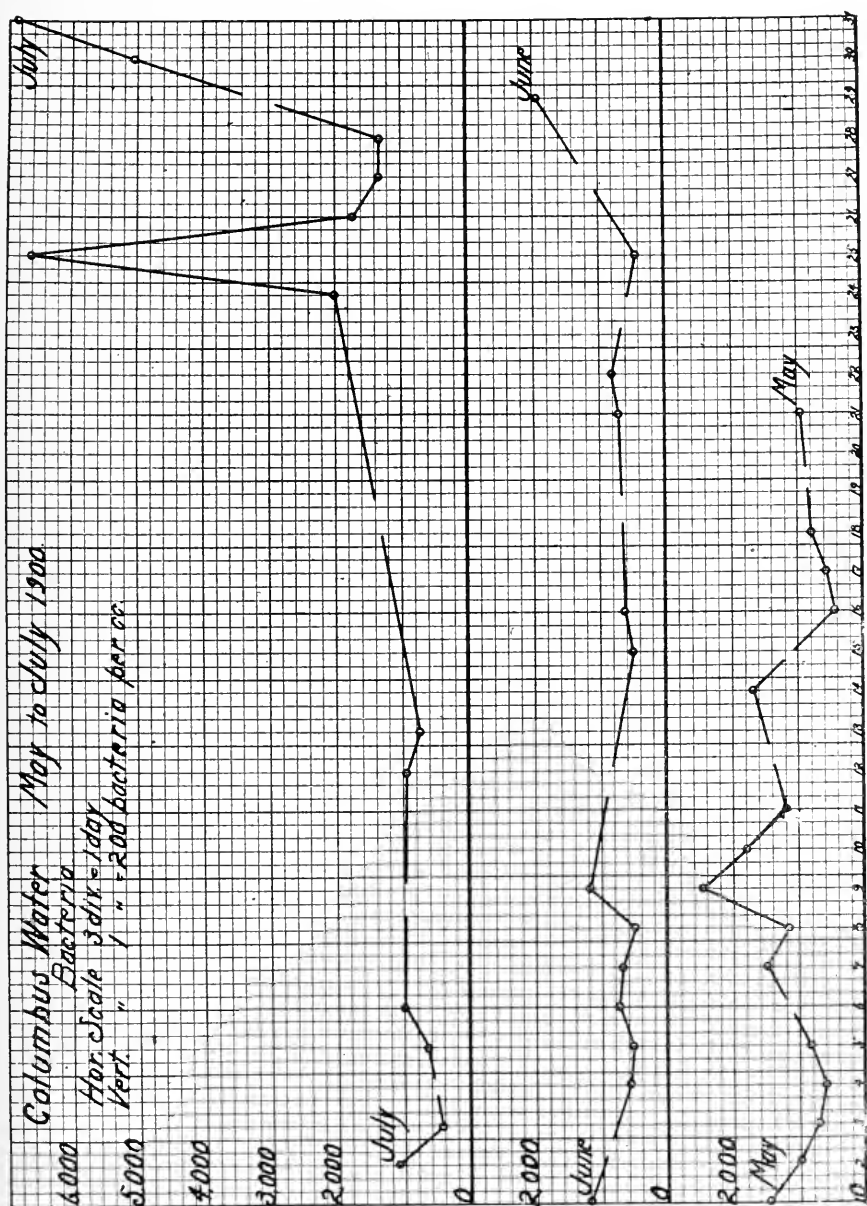
TABLE OF BACTERIAL FINDINGS IN COLUMBUS WATER.

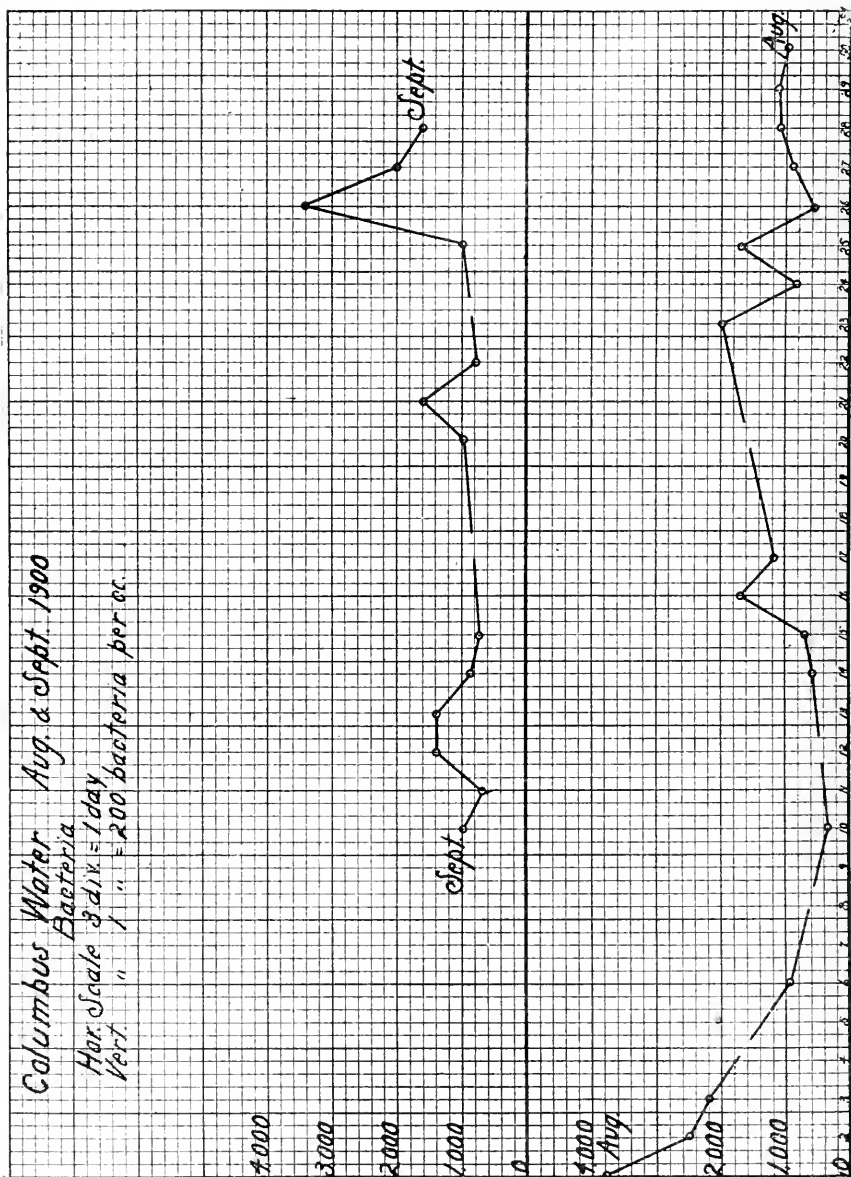
Month.	Days examined.	Maximum per c. c.	Minimum per c. c.	Average per c. c.
January	26	11,400	350	3,426
February	24	10,300	330	3,344
March	27	7,300	350	2,355
April	15	11,300	350	3,447
May	15	2,500	450	1,153
June	13	1,900	425	806
July	13	6,800	450	2,277
August	17	3,800	350	1,365
September	13	3,400	700	1,350
October	8	1,200	550	825
November	14	9,300	300	2,338
December	20	1,900	275	686

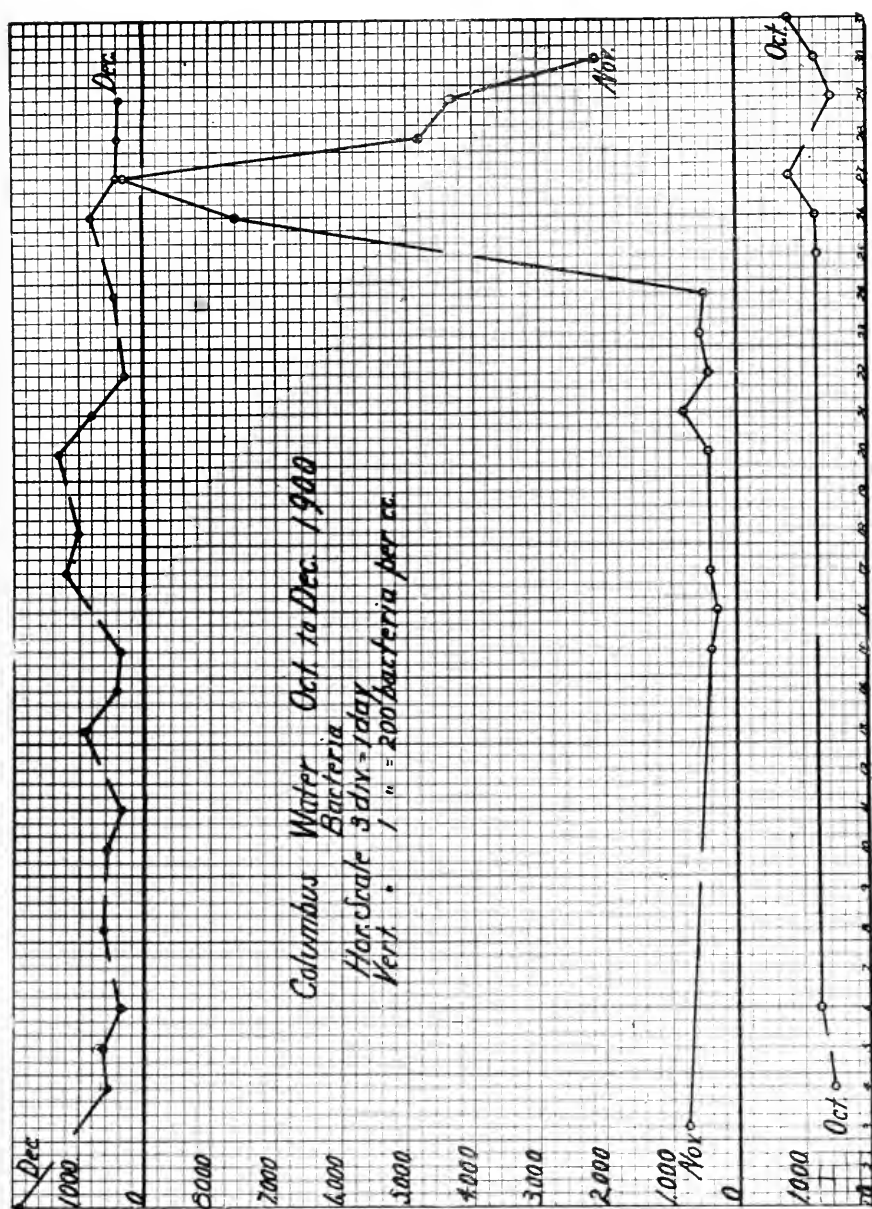












WATER SUPPLY OF DAYTON.

The water for this supply is derived from a series of drilled wells situated in the bed of Mad river. An addition to the system was recently made. See report on proposed additional water supply for Dayton in this volume.

In connection with the examination of water from the additional wells, the Board examined samples from some deep wells in the heart of the city. The results of these examinations are given here for comparison, and show the influence of the denser population. It is to be remembered that of the following only the first sample represents the water of the public supply. That sample was examined at the request of the local board of health because consumers were complaining of a sediment which appeared in the water at times in July and August. There was no sediment in the sample, nor had there been any complaints for several days preceding the date of sampling.

CHEMICAL EXAMINATION OF WATER FROM DAYTON.

PARTS PER MILLION.

Number.	Date collected.	Appearance			Nitrogen as			
		Sediment.	Turbidity.	Color.	Albuminoid ammonia.	Free ammonia.	Nitrites.	Nitrates.
1317	Aug. 27	trace	none	.05	.044	.022	.001	3.19
1051 ..	Apr. 18	none	none	none	.017	.096	.010	8.49
1344	Sept. 3	none	none	.09	.072	.108	.028	7.80
1523	Nov. 27	none	none	trace	.053	.118	.094	8.11
1524	Nov. 27	.....	.....	.....	.....	.....	.004	5.70

Oxygen required.	Chlorine.	Alkalinity.	Incrusting constituents.	Residue on evaporation.	
				Total.	Loss on ignition.
.96	9.7	253.0	22.4	409	107.
.73	121.1	286.2	89.0	712	207.
.65	119.2	274.8	51.8	737	196.
.74	100.2	.....	.....	648	155.
.....	65.0	.....	.....	.....	.....

All the samples were odorless. The first sample was from a hydrant in the city; the second, third, and fourth from a deep well in the heart of the city; the fifth from another deep well also in the business portion of

the city; No. 1,524 was a bacterial sample and the quantity of water was insufficient for the other findings. Samples 1,344, 1,523 and 1,524 contained respectively 80, 100 and 7 bacteria per cc., with no colon bacilli present.

WATER SUPPLY OF DENNISON.

[See special report in this volume.]

WATER SUPPLY OF GALION.

[See special report in this volume.]

WATER SUPPLY OF MIDDLETON.

The source of supply is a large dug well. At the request of the local board of health a sample of water taken from a faucet in the pumping station was examined.

CHEMICAL EXAMINATION OF WATER FROM MIDDLETOWN.

PARTS PER MILLION.

Number.	Date collected.	Appearance			Nitrogen as			
		Sediment.	Turbidity.	Color.	Albuminoid ammonia.	Free ammonia.	Nitrites.	Nitrates.
1367	Sept. 19	none	none	.07	.040	.001	none	4.12

Oxygen required.	Chlorine.	Alkalinity.	Incrusting constituents.	Residue on evaporation.	
				Total.	Loss on ignition.
0.59	3.5	257.8	43.4	352	68.

The sample was odorless, contained 7.50 degrees of dissolved oxygen per litre, 85 bacteria per cc., and no intestinal bacteria.

WATER SUPPLY OF MINGO JUNCTION.

The source of supply is the Ohio river. [See special report in this volume.]

At the request of the local board of health and on account of the prevalence of typhoid fever in the village, examinations were made of samples of water from the public supply, a public well and a public spring. Sample No. 971, taken from a hydrant, showed 1,400 bacteria per cc., and contained colon bacilli; sample No. 972, taken from a public spring, contained 49 bacteria per cc., but no colon bacilli were found; sample No. 973, from a public well, contained 19 bacteria per cc., with colon bacilli not found.

WATER SUPPLY OF OXFORD.

The source of supply is a dug well. Owing to an outbreak of typhoid fever in the village a request was received from the local board of health for an examination of the water of the public supply, and later of the water from a well on the university grounds. The public supply was found unpolluted, and the well at the university polluted.

CHEMICAL EXAMINATION OF WATERS FROM OXFORD.

PARTS PER MILLION.

Number.	Date collected.	Appearance			Nitrogen as			
		Sediment.	Turbidity.	Color.	Albuminoid ammonia.	Free ammonia.	Nitrites.	Nitrates.
1364	Sept. 18	none	none	trace	.086	.004	none	trace
1434	Oct. 16	trace	slight	trace	.057	.010	.005	2.32

Oxygen required.	Chlorine.	Alkalinity.	Incrusting constituents.	Residue on evaporation.	
				Total	Loss on ignition.
1.15	3.3	276.6	none	360	87.
.86	37.7	undetermined	undetermined	598	undetermined

The first sample was from a hydrant and represented the public supply; it had a faint woody odor. The second sample was from the university well and had an earthy odor. The first sample contained 21

bacteria per cc. and no intestinal bacteria; the second sample contained 1,950 bacteria per cc., with colon bacilli present.

WATER SUPPLY OF SHREVE.

The source of the supply is a drilled well situated in the village. See annual report of State Board of Health for 1899, page 128. A request was made of the State Board of Health for examination of a sample of water from this well and accordingly a sample was analyzed.

CHEMICAL EXAMINATION OF WATER FROM SHREVE.

PARTS PER MILLION.

Number.	Date collected.	Appearance			Nitrogen as			
		Sediment.	Turbidity.	Color.	Albuminoid ammonia.	Free ammonia.	Nitrites.	Nitrates.
944	1900 Feb. 15	none	none	trace	.012	.022	trace	.19

Oxygen required.	Chlorine.	Alkalinity.	Incrusting constituents.	Residue on evaporation.	
				Total.	Loss on ignition.
.72	82.8	246.2	none	442	76.

The sample had no odor.

WATER SUPPLY OF SPRINGFIELD.

The sources of supply are a dug well with a lateral gallery, an infiltration reservoir and Buck creek. When the bacteriologist of the State Board was in Springfield on the May river work, it was learned that a pipe had just been laid to admit water from Buck creek to the infiltration reservoir. Open communication between the well and the creek (by way of the reservoir) was possible, but had not been resorted to. Sample No. 1,125 was accordingly taken from a faucet in the pumping station on May 24th and showed 125 bacteria per cc. For the character of the water from Buck creek see Appendix I. The samples referred to were taken at the spot where the intake pipe reached the creek.

WATER SUPPLY OF TIFFIN.

The source of supply is a series of drilled wells supplemented at times by water from Sandusky river. For a fuller description of the supply see page 441 of the annual report of this Board for 1898. Owing to the complaints by consumers that the water was of poor quality, examinations of samples were made at the request of the local board of health.

CHEMICAL EXAMINATION OF WATER FROM TIFFIN.

PARTS PER MILLION.

Number.	Date collected.	Appearance			Nitrogen as			
		Sediment.	Turbidity.	Color.	Albuminoid ammonia.	Free ammonia.	Nitrites.	Nitrates.
1318	1900 Aug 27	very slight	.06	.24	.148	.108	.010	trace
1499	Nov. 8	.....	.....	.....	.....	.....	trace	.08

Oxygen required.	Chlorine.	Alkalinity.	Incrusting constituents.	Residue on evaporation.	
				Total.	Loss on ignition.
3.68	35 3	208 0	54.0	459	179.
.....	77.6	.....	.....	.....	.....

Both samples were taken from faucets in residences. The first sample had a vegetative odor and contained 450 bacteria per cc., with colon bacilli sparingly present. The second sample contained 150 bacteria per cc., but colon bacilli were not present.

WATER SUPPLY OF UHRICHVILLE.

[See water supply of Dennison.]

WATER SUPPLY OF WAUSEON.

The supply is derived from two drilled wells. See 1898 annual report, page 488. Owing to the prevalence of typhoid fever in the village the local board of health requested an examination of the water from their public supply.

CHEMICAL EXAMINATION OF WATER FROM WAUSEON.
PARTS PER MILLION.

Number.	Date collected.	Appearance			Nitrogen as			
		Sediment.	Turbidity.	Color.	Albuminoid ammonia.	Free ammonia.	Nitrites.	Nitrates.
1237	1900 July 17	none	none	.10	.044	.276	.005	trace

Oxygen required.	Chlorine.	Alkalinity.	Incrusting constituents.	Residue on evaporation.	
				Total.	Loss on ignition.
1.28	240.2	310.4	none	795	170.

The sample had but a trace of odor. By error on the part of the person collecting the samples the portion taken for bacteriological examination was obtained from a private well and is consequently not reported with the above analysis.

WATER SUPPLY OF WEST ALEXANDRIA.

The source of supply is a set of artesian wells. At the request of the local board of health examination was made of a sample of water from the artesian wells.

CHEMICAL EXAMINATION OF WATER FROM WEST ALEXANDRIA.
PARTS PER MILLION,

Number.	Date collected.	Appearance			Nitrogen as			
		Sediment.	Turbidity.	Color.	Albuminoid ammonia.	Free ammonia.	Nitrites.	Nitrates.
1381	1900 Sept 24	none	trace	.05	.062	.514	.010	none

Oxygen required.	Chlorine.	Alkalinity.	Incrusting constituents.	Residue on evaporation.	
				Total	Loss on ignition.
1.33	10.2	319.4	none	371	104.

EXAMINATIONS OF MISCELLANEOUS WATERS

PARTS PER

Sample number.	Place.	Source of sample.	Cause for examining.	Date collected.		Color.	Turbidity.	Sediment.	Odor.	Oxygen required.	
				Month.	Day.						
1362	Antwerp	Public well	Pollution.....	9	17	.12	S	T	Earthy	1.31	
1363	Antwerp	"	"	9	17	.10	T	T	Putrefactive ...	1.69	
1490	Arlington	Private well	Typhoid	11	7						
1491	"	"	"	11	7						
1492	"	"	"	11	7						
1493	"	"	"	11	7						
1494	"	"	"	11	7						
1513	Attica	"	"	11	19						
1321	Barberton	"	"	8	28						
1373	"	"	Bowel trouble	9	19	.10	None	T	None .....	.70
1374	"	"	"	9	19	.20	.08	V. S.	"	.31	
1407	"	"	Typhoid	10	3	.00	None	None	"	.61	
1408	"	"	Bowel trouble	10	3	.00			"	.53	
1387	Bedford	"	Typhoid	9	27	.09	T	"	"	1.54	
994	Bellevue	Cistern.....	"	3	23						
1508	Bethel tp Miami c.	Private well	"	11	15						
1347	Bloomingsburg ..	"	"	9	10	.06	None	T	None.....	.93	
938	Brink Haven	Spring	"	2	12						
	Cambridge	See page —									
1231	Canton	Private well	Typhoid	7	312						
912	Congo	"	"	1	25	.07	.06	None	None.....	1.63	
913	Congo	Cistern.....	Cf. 912	1	25	.20	.08	T	Woody.....	2.99	
	Dayton	See page —									
1539	Delaware	Private well	Typhoid	12	10						
1529	Delaware Bend ..	"	"	12	1						
1530	"	"	"	12	1						
1531	"	"	"	12	1						
1532	"	"	"	12	1						
948	Demos	Spring	"	2	320						
949	"	"	"	2	320						
1299	Dublin	Private well	Typhoid	8	22						
1300	"	Town well ..	"	8	22						
1301	"	Private well	"	8	22						
1302	"	"	"	8	22						
1303	"	Public well.	"	8	22						
1304	"	Private well	"	8	22						
1305	"	"	"	8	22						
1410	Forest	Town well ..	Pollution	10	5						
1411	"	"	"	10	5						
1166	Frazeysburg	Private well	Typhoid	6	13	.20	None	V. S.	Woody.....	1.17	
1167	"	"	"	6	13	.05	"	T	Peculiar.....	1.16	
1168	"	"	"	6	13						
1384	Gettysburg	"	"	9	26						
1478	Girard	"	"	11	2						
1455	Hartville	"	"	10	29	.05	None	T	Ft. putrefactive	.72	
1388	Le Moyne	"	"	9	26	.05	"	None	None.....	1.25	
1257	Lisbon	"	Quality	8	1						
1348	"	"	Typhoid	9	10						
1503	"	Spring	"	11	14						
1399	London	Private well	Bowel trouble	10	2		T	.05	S	Putrefactive89
1065	Lowell	"	Typhoid	4	25						
1182	"	"	"	6	19						
1351	"	School well.	"	9	12	0	None	None	None.....	.78	
1537	"	Spring	"	12	7	.10	T	T	Ft. woody.....	.78	
1520	Marlboro	Private well	"	11	26						
1445	Marshallville	"	"	10	24						
1446	"	"	"	10	24						
1447	"	"	"	10	24						
1515	Marysville	School well	"	11	23	.18	.33	Cons.	Earthy	9.01	
1518	"	"	"	11	23						
970	Mingo Jct.	Spring	"	3	5						
1458	Moorefield	Town well.	"	11	1						
1459	"	Private well	"	11	1						
1460	"	"	"	11	1						
1461	"	"	"	11	1						
1462	"	"	"	11	1						

EXAMINATIONS OF MISCELLANEOUS WATERS FROM

Number.	Place.	Source of sample.	Cause for examining.	Date collected.		Color.	Turbidity.	Sediment.	Odor.	Oxygen required.
				Month.	Day.					
1463	Moorefield	Private well	Typhoid	11	1	.....	.....	.....	.....	.....
1464	"	"	"	11	1	.....	.....	.....	.....	.....
1465	"	"	"	11	1	.....	.....	.....	.....	.....
1505	New Stark	Tp. well ...	"	11	13	.....	.....	.....	.....	.....
1506	"	Private well	Typhoid	11	13	.....	.....	.....	.....	.....
1507	"	"	"	11	13	.....	.....	.....	.....	.....
1353	Ostrander	"	"	9	13	.....	.....	.....	.....	.....
1354	"	Town and tp. well ..	"	9	13	.....	.....	.....	.....	.....
1355	"	Priv'te well	"	9	13	.....	.....	.....	.....	.....
	Oxford	See page ...								
1066	Piqua	Priv'te well	Typhoid	4	25	0	None	None	None.....	1.09
1423	"	"	"	10	10	0	"	"	Earthy.....	1.05
1547	Plymouth	"	"	12	19	.24	S	V. S.	Ft. Woody	3.36
1193	Prairie tp Frank. c.	"	"	6	21	.....	.....	.....	.....	.....
1238	"	"	"	7	19	.15	T	T	Peculiar.....	3.90
1239	"	"	"	7	19	.14	T	T	"	2.78
1522	Randolph	Spring	"	11	26	.....	.....	.....	.....	.....
1555	Range	Priv'te well	"	12	24	.....	.....	.....	.....	.....
924	Rendville	"	"	2	4	.....	.....	.....	.....	.....
925	"	"	"	12	4	.....	.....	.....	.....	.....
926	"	"	"	12	4	.....	.....	.....	.....	.....
1457	Savona	"	"	10	31	.15	.07	S	Earthy	1.50
901	Smith tp. Bel. c.	School well.	Pollution.....	1	15	.0	.19	C	None.....	2.92
1280	Springfield	Buck Creek, Snyder Park	"	8	9	.22	.....	S	Musty	2.71
	Union Furnace ..	See page...								
1546	Union tp. Ross c.	Priv'te well	Typhoid	12	17	.....	.....	.....	.....	.....
1073	Warren	Public well.	Quality	4	26	.10	.81	C	Ft. oily.....	5.08
1435	Washington tp.	"	"	9	10	.....	.....	.....	.....	.....
	Jackson co.	Priv'te well	Typhoid	10	16	.....	.....	.....	.....	.....
1345	Waterford	"	"	9	10	.....	.....	.....	.....	.....
1039	Wauseon	"	"	4	*14	.60	.06	.....	Musty.....	1210
1107	"	"	"	5	22	.18	T	V. S.	None.....	3.57
1379	Waverly	School well.	Quality	9	*21	.05	S	S	"	2.46
1191	York tp. Sansusky co.	Priv'te well	Typhoid	6	21	.....	.....	.....	.....	.....
1454	Zanesville	"	"	10	29	.05	None	T	Earthy.. .....	.81

PRIVATE SUPPLIES AND SPECIAL SOURCES—Concluded.

Nitrogen as				Chloride.	Alkalinity.	Incrusting Constituents.	Total solids.	Loss on ignition.	Character of Bacteria.	Bacteria per c. c.	Remarks.
Albuminoid ammonia.	Free ammonia.	Nitrites.	Nitrates.								
....	....	.000	22.70	77.2	.....	.....	.....	.....	W	300	Undesirable.
....	....	.003	26.05	69.4	.....	.....	.....	.....	Colon	4,700	Polluted.
....	....	.000	None	90.2	.....	.....	.....	.....	W	2,400	Undesirable.
....	....	.000	T	6.4	.....	.....	.....	.....	W	400	Potable.
....	....	.000	T	6.8	.....	.....	.....	.....	W	8	Potable.
....	....	.003	14.40	115.4	.....	.....	.....	.....	Colon	4,700	Polluted.
....	....	.002	1.01	27.6	.....	.....	.....	.....	W	160	Usable.
....	....	.000	T	25.2	.....	.....	.....	.....	W	26	Potable.
....	....	.009	.53	49.4	.....	.....	.....	.....	W	375	Suspicious.
.064	.008	.003	18.00	43.2	289.8	102.4	845	364	W	....	Advised protection if not abandoned.
.104	.016	.005	5.98	50.8	.....	.....	681	.....	W	950	Suspicious.
.152	.024	.007	11.68	110.2	.....	.....	.....	.....	Colon	1,500	Polluted. Ordered closed.
....	....	.011	16.10	247.0	.....	.....	.....	.....	Colon	.....	Polluted. Ordered closed.
.258	.114	.062	29.10	142.6	567.8	87.8	1710	851	Colon	5,700	Polluted. Ordered closed.
.128	.078	.032	15.60	46.6	435.2	88.0	879	342	Colon	1,800	Polluted. Ordered closed.
....	....	.000	4.83	1.9	.....	.....	.....	.....	W	27	Usable.
....	....	.000	1.65	16.2	.....	.....	.....	.....	Colon	650	Polluted. Advised abandon'g.
....	....	.003	19.52	70.6	.....	.....	.....	.....	Colon	2,250	Polluted. Ordered closed.
....	....	....	19.52	70.6	.....	.....	.....	.....	Colon	2,100	Polluted. Ordered closed.
....	....	....	19.52	70.6	.....	.....	.....	.....	Colon	2,050	Polluted. Ordered closed.
.076	.344	T	T	17.5	.....	.....	532	.....	W	7	Usable.
.074	.002	.000	None	2.7	462.4	63.6	741	208	.....	.....	Usable.
.184	.188	.050	1.53	7.1	253.8	None	396	143	.....	9,600	Polluted.
....	....	.003	21.20	33.9	.....	.....	.....	.....	W	450	Advised abandoning.
.042	.522	.000	None	58.8	475.4	None	1288	294	.....	.....	Undesirable mineral water.
....	....	.000	T	T	.....	.....	.....	.....	W	1,500	Usable. Advised protection.
....	....	.080	8.10	76.4	.....	.....	.....	.....	Colon	37,000	Polluted. Ordered closed.
.494	.210	.440	12.50	108.5	.....	.....	.....	.....	.....	.....	Polluted. Ordered closed.
.164	.034	.012	15.69	125.6	343.0	164.4	1012	311	.....	.....	Polluted.
.063	.059	.005	8.74	5.1	153.8	30.0	402	135	.....	.....	Usable. Advised protection.
....	....	.100	.....	669.0	.....	.....	.....	.....	W	9	Advised full sanitary analysis.
.053	.024	.008	12.50	49.5	.....	.....	923	.....	Suspicious	1,500	Suspicious. Further information requested.

W. In determining the character of the bacteria present in a sample, no attempt was made to isolate and study other than intestinal species, and W means that species normally found in the intestines of man or animals were *wanting* in the water under investigation.

EXAMINATION OF RIVER SAMPLES.

The results of the examinations of samples of water taken from the Great and Little Miami rivers during 1900, will be found under a separate heading in a subsequent portion of this report.

SUMMARY OF LABORATORY WORK FOR 1900.

During the year analyses have been made of 759 samples, divided as follows: Diphtheria, 42; waters, 671; miscellaneous, 46. Many of the waters received chemical and bacteriological examinations and sometimes biological as well, hence the 759 samples caused 1,482 distinct examinations to be made. Attention is called to the fact that a water analysis involves more labor than most of the other analyses required of a public health laboratory, and as the large majority of the samples were waters, the mere number gives a poor conception of the amount of work done by the laboratory.

LIST OF
CITIES AND VILLAGES
HAVING
BOARDS OF HEALTH
WITH NAME OF
HEALTH OFFICER.

August 1, 1901.

HEALTH OFFICERS.

CITIES.

Akron	Dr. A. A. Kohler.
Alliance	Dr. P. W. Welker.
Bellaire	Dr. D. W. Boone.
Bucyrus	Dr. W. A. Daugherty.
Canton	Dr. J. F. Marchand.
Chillicothe	Dr. W. S. Scott.
Cincinnati	Dr. Clark W. Davis.
Circleville	Mr. Wm. H. Dunkel.
Cleveland	Dr. Martin Friedrich.
Columbus	Dr. W. D. Deuschle.
Dayton	Dr. C. W. King.
Defiance	Dr. E. E. K. Chapman.
Delaware	Dr. J. K. James.
East Liverpool	Dr. C. B. Ogden.
Fremont	Dr. O. H. Thomas.
Findlay	Mr. Amos Beardsley.
Fostoria	Mr. W. N. Caldwell.
Galion	Dr. H. H. Hartman.
Gallipolis	Dr. F. A. Cromley.
Greenville	Dr. John D. Kerlin.
Hamilton	Dr. Aug. Schumacher.
Ironton	Dr. J. W. Lowry.
Kenton	Mr. Geo. W. Schindewolf.
Lancaster	Dr. F. P. Stukey.
Lima	Dr. E. E. McCall.
Mansfield	Dr. J. Harvey Craig.
Marietta	Dr. J. B. McClure.
Massillon	Dr. T. Clarke Miller.
Martins Ferry	Dr. J. W. Darrah.
Marion	Dr. E. H. Raffensperger.
Middletown	Dr. Geo. D. Lummis.
Mt. Vernon	Dr. H. W. Blair.
Newark	Dr. Henry Day.
Norwalk	Dr. Edgar Martin.
Piqua	Dr. F. E. Kitzmiller.
Pomeroy	Dr. R. E. Stobart.
Portsmouth	Dr. Louis A. Vernier.
Salem	Dr. A. C. Yengling.
Sandusky	Dr. Wm. H. Busch.
Steubenville	Mr. John Welch.
Springfield	Dr. Henry H. Seys.
Tiffin	Dr. A. C. Schwartz.
Toledo	Dr. W. W. Brand.
Troy	Dr. E. N. Loy.
Urbana	Dr. H. M. Pearce.
Warren	Dr. D. E. Hoover.
Washington C. H.	Mr. J. M. Edwards.
Wellston	Mr. Thomas McGuire.

Wellsville	Mr. Jos. T. Warren.
Wooster	Dr. R. N. Sheldon.
Xenia	Dr. A. D. DeHaven.
Youngstown	Dr. H. E. Welch.
Zanesville	Dr. Charles P. Sellers.

VILLAGES.

Aberdeen	Dr. W. O. Eaton.
Ada	Mr. W. H. Morrow.
Adamsville	Mr. S. J. Lane.
Addyston	Mr. Hugh Kennedy.
Albany	Dr. A. F. Holmes.
Alger	Dr. U. P. L. Vermillion.
Alvordton	Dr. T. E. Schrider.
Andover	Mr. L. W. Houghton.
Anna	Dr. C. W. B. Harbour.
Ansonia	Dr. H. A. Snorf.
Antwerp	Dr. Geo. M. Brattain.
Apple Creek	Mr. W. H. Winkler.
Arcadia	Mr. F. L. Smart.
Arcanum	Mr. E. B. Hawley.
Archbold	Mr. August Ruibley.
Arlington	Mr. W. D. Sebastian.
Ashland	Dr. B. Myers.
Ashtabula	Dr. A. W. Hopkins.
Ashley	Dr. H. N. Coomer.
Ashville	Mr. J. W. Johnson.
Athens	Dr. J. M. Higgins.
Attica	Dr. C. A. Force.
Avon	Dr. T. B. Daily.
Bainbridge	Dr. R. H. McKee.
Bakersville	Dr. J. D. Lower.
Baltimore	Dr. C. M. Alt.
Barberton	Dr. F. Lahmers.
Barnhill	Mr. John Stevenson.
Barnesville	Mr. W. A. Talbot.
Batesville	Mr. Caleb Mercer.
Beach City	Dr. I. M. Pfouts.
Beallsville	Dr. John W. Reed.
Beaver Dam	Dr. J. B. Haines.
Bedford	Mr. C. W. Kerslake.
Bellbrook	Mr. G. H. Lamb.
Belle Center	Mr. J. F. Ewing.
Bellefontaine	Dr. J. S. Deemy.
Belleville	Dr. N. R. Eastman.
Bellevue	Dr. E. D. Smith.
Belmore	Dr. G. B. Adrian.
Belmont	Mr. David S. Pierce.
Benton Ridge	Dr. R. D. Whisler.
Berea	Dr. E. O. Hess, Clerk.
Berne	Dr. G. G. Mallett.
Berlin Heights	Dr. G. W. Hine.
Bethel	Dr. Julius D. Abbott.
Bettsville	Mr. R. R. Ridley, Clerk.

Beverly	Mr. Jos. E. Hall.
Blanchester	Dr. S. B. Judkins.
Bloomington	Mr. L. Dellinger.
Bloom Centre	Dr. O. C. Wilson.
Bloomdale	Mr. E. Wineland.
Bloomington	Mr. E. R. Blackburn, Clerk.
Bloomville	Dr. T. C. Loose.
Bluffton	Dr. John J. Sutter.
Bond Hill	Mr. D. Edw. Murphy.
Botkins	Mr. Allen Wical.
Bourneville	Dr. D. S. Smith.
Bowerston	Dr. C. E. Siegrist.
Bowersville	Mr. S. A. Bowermaster.
Bowling Green	Mr. A. Ordway.
Bradford	Mr. John Tinkler.
Bradner	Mr. J. C. Duffield.
Bridgeport	Dr. V. Wagener.
Brilliant	Dr. F. L. Dugall.
Brooklyn	Mr. Wm. Treat.
Brookfield	Mr. W. A. McIntosh.
Brookville	Dr. V. Z. Miller.
Broughton	Mr. J. K. Sierer.
Bryan	Mr. Nicholas Vineyard.
Buckeye City	Mr. J. H. Knepper.
Buchtel	Dr. H. T. Lee.
Brink Haven	Mr. J. N. House, Mayor.
Burbank	Mr. A. W. Hoffman.
Butler	Dr. E. G. Rummel.
Burton	Dr. B. F. Ray.
Byesville	Mr. D. F. Morrow.
Cadiz	Dr. S. H. Kent.
Caldwell	Dr. A. H. Andrus.
Caledonia	Mr. Noah Lee.
Calais	Mr. Josiah Thomas.
Cambridge	Mr. T. C. Stanley.
Camden	Dr. John Whittaker.
Canal Dover	Mr. Henry Breitenstine.
Canal Fulton	Mr. George Becker.
Canal Winchester	Dr. W. S. Gayman.
Canfield	Mr. A. D. Wood.
Cardington	Mr. W. H. Van Horn.
Carey	Dr. J. H. Ferrell.
Carroll	Dr. H. A. Brown.
Carrollton	Dr. A. H. Hise.
Carthage	Mr. J. G. Henderson.
Catawba	Dr. T. D. Beach.
Cecil	Dr. S. E. Demuth.
Cedarville	Mr. David H. McFarland.
Celina	Dr. L. P. Lisle.
Centerburg	Mr. J. C. Coe.
Chagrin Falls	Mr. W. J. Clark.
Chardon	Mr. N. M. Goodrich.
Chester Hill	Dr. J. A. Penrose.
Chesterville	Dr. W. C. Hodges.

Chicago Junction	Dr. R. N. Reynolds.
Chickasaw	Mr. H. S. Schaefer.
Clarington	Mr. John E. Morrill.
Clarksville	Dr. Z. T. Garland.
Clarksburg	Dr. J. F. Simpkins.
Clearport	Dr. T. J. Hufford.
Cleves	Dr. C. W. Smedley.
Clifton	Dr. J. H. Harris.
Coalton	Mr. M. K. Glenn.
Coal Grove	Dr. S. A. Lambert.
Clyde	Mr. F. G. Tuttle.
College Hill	Mr. J. E. Deininger.
Collinwood	Dr. P. E. Kerlin.
Columbiana	Mr. Geo. Roninger.
Columbus Grove	Dr. W. H. Begg.
Commercial Point	Mr. W. J. Rout.
Congress	Mr. Clyde M. Holmes.
Conneaut	Dr. D. S. Cossitt.
Continental	Mr. E. S. Drummond.
Convoy	Dr. B. F. Leslie.
Coolville	Dr. A. M. Frame.
Copley	Mr. O. E. Arnold.
Corning	Mr. Wm. Anderson.
Cortland	Dr. K. W. Lynn.
Coshocton	Dr. J. E. Foster.
Covington	Mr. H. E. Finfrock.
Crestline	Mr. A. J. Cover.
Creston	Mr. Philip Baum.
Cridersville	Mr. George Crider.
Croton	Dr. S. S. Reynolds.
Crown City	Dr. H. P. Gerlach.
Crooksville	Mr. Fred Young.
Cumberland	Mr. George E. McEndree.
Custar	Dr. M. Woeline.
Cuyahoga Falls	Mr. I. N. Ried.
Cygnets	Mr. D. J. Baker.
Dalton	Mr. A. H. Arick.
Danville	Dr. C. R. Bradfield.
Darbyville	Mr. M. N. Bowman.
Deersville	Dr. Frank James.
DeGraff	Mr. John Hendershott.
Delta	Dr. W. E. Ramsey.
Delhi	Dr. L. A. Haber.
Dell Roy	Mr. Isaac Russell.
Delphos	Dr. N. E. Brundage.
Dennison	Dr. L. H. Hughes.
Deshler	Mr. James E. Robinson.
Dillons	Dr. G. B. Trout.
Dillonvale	Dr. C. W. Mercer.
Donnelsville	Dr. Horace Heistand.
Doylestown	Mr. Richard Martin.
Dresden	Mr. C. W. Carter.
Dublin	Dr. C. L. Dolle.
Dupont	Mr. T. R. Harte.

East Cleveland	Mr. J. H. Stamberger.
East Fairfield	Dr. G. H. Albright.
East Palestine	Mr. L. Neville.
Eaton	Mr. F. Campbell.
Edgerton	Dr. C. Hathaway.
Edison	Dr. J. H. Jackson.
Edon	Mr. H. F. Alwood.
Eldorado	Dr. A. C. Carney.
Elida	Dr. W. H. Ely.
Elgin	Dr. L. P. Jackson.
Elmore	Mr. R. A. Willett.
Elyria	Dr. W. E. Hart.
Elmwood Place	Dr. E. T. Busching.
Enon	Mr. James P. Pierce.
Fairfield	Mr. Samuel Wilson.
Fairport	Mr. A. J. McCue.
Fairview	Dr. F. W. Lane.
Fayette	Mr. Horace W. Ford.
Felicity	Mr. C. J. Young.
Fernbank	Mr. James E. Hickman.
Fletcher	Dr. J. Funderburg.
Flushing	Dr. Thomas Blackwood.
Forest	Dr. W. T. Gemmill.
Fort Jennings	Dr. J. F. George.
Fort Recovery	Dr. Theodore Snapp.
Fowler	Mr. C. D. Williamson.
Frankfort	Dr. L. N. Matteson.
Franklin	Dr. D. A. Williams.
Frazeysburg	Mr. Wm. Host.
Fredericksburg	Dr. D. P. Schie.
Fredericktown	Mr. C. W. Burk.
Freeport	Mr. W. H. Lewis.
Fultonham	Dr. C. B. Moore.
Gahanna	Mr. Samuel Cashner, Mayor.
Gambier	Dr. A. D. Welker.
Garrettsville	Dr. C. A. Snow.
Geneva	Dr. F. C. Smith.
Germantown	Mr. Wm. Schaeffer.
Gibsonburg	Mr. Wm. Fought.
Gilboa	Dr. M. A. Darbyshire.
Girard	Dr. D. R. Williams.
Glandorf	Mr. Jacob Meyerhofer.
Glendale	Mr. Clifford Allen.
Glenville	Mr. Andrew Carr.
Glouster	Dr. J. M. Rhodes.
Good Hope	Mr. D. C. Somers.
Grafton	Mr. C. N. Storrs.
Grand Rapids	Mr. Wm. Mailey.
Grand River	Mr. H. J. Valteau.
Gratis	Mr. Alfred Johnson.
Granville	Dr. A. K. Follett.
Graysville	Mr. W. E. Barker.
Green Camp	Mr. G. W. Collins.
Greenfield	Mr. Joseph Irons.

Green Springs	Dr. R. D. Reynolds.
Greenwich	Mr. J. H. Baker.
Grove City	Mr. Theo. Jahn.
Grover Hill	Mr. C. F. Foos.
Groveport	Dr. C. R. Clement.
Hagermans	Mr. G. B. Weaver.
Hamden Junction	Mr. Wm. Bagley.
Hamler	Mr. N. J. Blinn.
Hanging Rock	Mr. Jos. Kinkaid.
Hanoverton	Mr. H. A. Sinclair.
Harrison	Dr. W. A. Axby.
Harrisburg	Mr. C. H. Copeland, Clerk.
Harrisville	Mr. W. C. Toland, Mayor.
Harrod	Mr. John Blair, Sr.
Hartwell	Dr. O. W. Butler.
Haskins	Dr. E. B. Holst.
Harveysburg	Dr. J. E. Whitham.
Haviland	Dr. E. L. Vermilya.
Hayesville	Mr. Dill Address.
Hebron	Dr. M. L. Scarbrough.
Herring	Dr. N. Sager, Jr.
Hicksville	Mr. B. L. Kelsey.
Higginsport	Dr. H. S. Guthrie.
Hilliards	Dr. J. W. Reason.
Hillsborough	Dr. S. R. Howard.
Holgate	Mr. B. W. Justice.
Hollansburgh	Dr. A. W. Meek.
Home City	Dr. B. F. Lehman.
Holmesville	Dr. Edgar Cole.
Hopedale	Dr. L. A. Crawford.
Hoytville	Mr. W. N. Hood.
Hubbard	Dr. W. H. Button.
Hudson	Dr. H. L. Waite.
Huntsville	Dr. G. W. Jones.
Huron	Mr. S. N. Lennon.
Hyde Park	Dr. Arthur L. Brown.
Irondale	Mr. Alex. Hamlin.
Independence	Mr. James C. Neville.
Ithaca	Dr. J. C. Hamilton.
Jackson	Mr. Henry Simmers.
Jacksonville	Mr. John Stamm.
Jackson Centre	Mr. J. C. Holston.
Jamestown	Mr. A. Ziner.
Jefferson	Dr. A. L. Arner.
Jeffersonville	Dr. D. H. Rowe.
Jeneca	Mr. C. H. Heldman.
Jerusalem	Mr. J. A. Latham.
Jerry City	Mr. H. P. Guinan.
Jersey	Dr. S. S. Richards.
Jewett	Mr. Isaiah McMannis.
Johnstown	Dr. C. A. Burke.
Johnsonville	Mr. E. C. Hitchcock.
Junction City	Dr. J. A. Moody.
Kalida	Mr. Jefferson Ladd.

Kelly's Island	Mr. Henry Elfers.
Kent	Mr. S. L. Gillette.
Killbuck	Dr. E. J. Heinig.
Kimbolton	Mr. S. A. Clark .
Kingston	Dr. C. C. Hatfield.
Kirby	Dr. E. E. Burns.
Kossuth	Mr. T. J. Barnett.
Lakeside	Mr. William Carroll.
Lakewood	Dr. A. E. McClure.
Lakeview	Dr. V. F. Barrett.
La Grange	Dr. G. N. Snyder.
Larue	Mr. R. J. Myers.
Latty	Dr. C. W. Gordon.
Laurelville	Mr. Jacob S. Haynes.
Laura	Dr. S. P. Neff.
Lebanon	Dr. G. M. Curry.
Leesburg	Dr. H. A. Beeson.
Leetonia	Dr. H. B. Kurtz.
Leipsic	Dr. John McClung.
Lewisburg	Mr. E. E. Black.
Lewisville	Dr. L. P. Diehl.
Lexington	Dr. H. H. Smith.
Liberty Center	Mr. D. K. Bowker.
Lisbon	Mr. W. C. Supplee.
Lithopolis	Mr. E. S. Stotz.
Lockington	Dr. J. Robert Caywood.
Lockland	Mr. M. Guth.
Lodi ..	Mr. Henry Selders.
Logan	Dr. D. A. Rannels.
London	Dr. M. Vance.
Lorain	Dr. Edward V. Hug.
Loramies	Dr. Thomas Walkup.
Loudonville	Mr. Wm. Conrad.
Louisville	Dr. C. A. Walker.
Loveland	Dr. C. Haarlammert.
Lowell	Dr. G. A. Phillips.
Lowellville	Mr. J. H. McWilliams .
Lower Salem	Dr. W. S. Williams.
Lynchburg	Mr. Jerry Archer.
Macksburg	Mr. R. C. Smithson.
Madison	Mr. J. V. Winans.
Madisonville	Dr. C. L. Metz.
Magnetic Springs	Dr. C. L. Schwartz.
Magnolia	Mr. L. H. Scheideger.
Maineville	Mr. E. S. Garwood.
Malinta	Mr. Chas. Spangler.
Malta	Mr. John Davis.
Malvern	Dr. E. C. Ross.
Manchester	Dr. J. D. Jordan.
Marblehead	Mr. A. J. Clemons.
Marseilles	Mr. John C. Wartley.
Marshallville	Dr. H. B. Willford.
Martinsville	Dr. W. K. Ruble.
Marysville	Dr. John E. Wood.

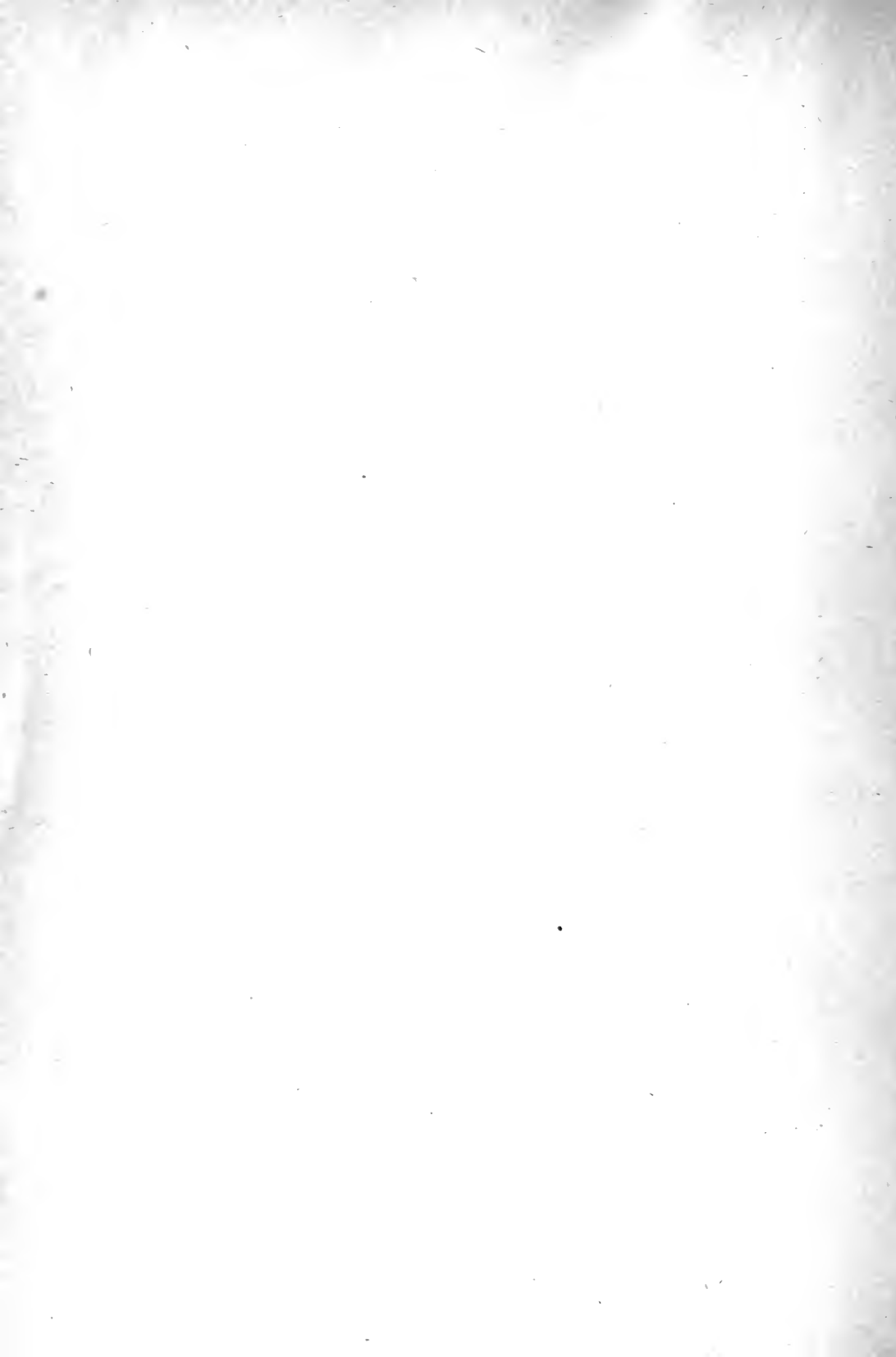
Mason	Dr. C. T. Hall.
Maumee	Mr. P. Hartman.
Marengo	Mr. Edgar Kerr.
McArthur	Mr. Walter B. Lyle.
McComb	Dr. J. A. Howell.
McConnelsville	Mr. Wm. Dille.
McGuffey	Dr. J. B. K. Evans.
Mechanicsburg	Dr. John C. Hathaway.
Medina	Mr. F. L. Harding.
Melrose	Mr. T. J. Myers.
Mendon	Dr. W. P. Clay.
Mentor	Dr. Lester H. Luse.
Metamora	Mr. B. M. Blaine.
Midland City	Dr. E. C. Van Gundy.
Middle Creek	Dr. G. E. Davis.
Middleport	Dr. David Sisson.
Miamisburg	Dr. C. F. Ginn.
Milan	Mr. Richard Rawl.
Milford ..	Dr. F. C. Curry.
Milford Center	Mr. Thomas Connor.
Miltonsburg	Dr. W. Handenschild.
Milton Center	Dr. J. F. Noble.
Milledgeville	Dr. James Cowan.
Millers	Mr. M. McCown.
Millersburg	Mr. C. J. Fisher.
Mineral Ridge	Dr. J. M. Elder.
Minerva	Mr. J. C. Young.
Mingo Junction	Mr. F. S. Buchanan.
Minster	Dr. R. A. Rulmann.
Monroeville	Dr. E. R. Kreider.
Montpelier	Dr. Blair Hagerty.
Morristown	Mr. R. S. Hazlett.
Morrow	Mr. E. Wilkerson.
Moscow	Mr. Barney Wolf.
Mt. Blanchard	Dr. R. N. Lee.
Mt. Cory	Mr. Jacob Doty.
Mt. Healthy	Dr. J. Ferris.
Mt. Gilead	Dr. F. C. Griffis.
Mt. Pleasant ..	Mr. Thos. P. Gorsuch.
Mt. Orab	Mr. John Walker.
Mt. Sterling	Mr. C. T. Gallagher.
Mt. Washington	Dr. W. C. Langdon.
Mt. Victory	Dr. A. N. Titsworth.
Murray City	Dr. T. J. Dillinger.
Mutual	Mr. C. M. Goul.
Napoleon	Mr. O. E. Barnes.
Navarre	Mr. John Bailiss.
Nelscnville	Dr. C. E. Welch.
Nevada	Dr. S. S. Barrett.
Neville	Dr. N. S. Hill.
New Albany	Mr. Christopher Horlocker.
New Athens	Dr. Albert Dickerson.
Newburgh	Dr. E. G. Radway.
New Bremen	Dr. M. S. Ekermeier.

New Carlisle	Dr. A. A. Luther.
Newcomerstown	Mr. D. C. Whiting, Jr.
New Concord	Mr. J. W. McKinney.
New Holland	Mr. Samuel McGath.
New Knoxville	Dr. H. E. Fledderjohann.
New Lexington	Mr. W. T. Rambo.
New London	Mr. A. M. Turner.
New Madison	Mr. J. F. S. Hageman.
New Metamoras	Mr. Adam S. Miracle.
New Paris	Dr. J. Harvey Guthrie.
New Philadelphia	Dr. George H. Peck.
New Richmond	Dr. J. A. Windsor.
New Riegel	Mr. Anthony Imber.
New Straitsville	Mr. Thomas Taylor.
Newton Falls	Mr. A. C. Lawton.
New Vienna	Dr. C. A. Stout.
New Washington	Dr. Burton R. Miller.
Ney	Dr. P. M. Lehman.
Niles	Dr. Henry V. Ormerod.
North Amherst	Dr. N. H. Cornwell.
North Baltimore	Dr. J. W. Stoner.
North Lindale	Mr. H. Gearity.
North Lewisburg	Mr. A. Spain.
North Robinson	Mr. J. J. Robertson.
Norwich	Mr. L. D. Wilson, Secretary.
Norwood	Dr. J. C. Cadwallader.
Oak Harbor	Mr. Ephriam Gordon.
Oak Hill	Mr. Wm. Jenkins.
Oakwood	Mr. W. E. Osborne.
Oakley	Mr. E. C. Wamacks.
Oberlin	Mr. W. L. Biggs.
Ohio City	Mr. S. R. Mapes.
Olmstead Falls	Mr. H. B. Northrop.
Orrville	Dr. A. A. Brooks.
Osborne	Dr. R. O. Hoover.
Osgood	Mr. H. H. Brander.
Osnaburg	Dr. W. D. Davis.
Ostrander	Dr. A. J. Pounds.
Ottawa	Dr. E. L. Tupper.
Ottoville	Dr. A. Binder.
Otway	Mr. Simon Crow.
Owensville	Dr. G. G. Rutledge.
Oxford	Mr. W. E. Calohan.
Patterson	Mr. P. C. Breidenbach.
Painesville	Dr. E. D. Whitney.
Pataskala	Mr. Frank McConaughy.
Paulding	Dr. John H. Hosford.
Payne	Dr. J. E. Mulligan.
Peebles	Dr. O. W. Robe.
Pemberville	Dr. R. J. Simon.
Peninsula	Dr. W. N. Boerstler.
Perrysburg	Dr. J. H. Reinfrank.
Perrysville	Mr. George W. Shehan.
Philo	Dr. G. B. Trout.

Piketon	Mr. Samuel M. Killison.
Pioneer	Mr. S. P. Waters.
Plain City	Dr. E. S. Holmes.
Pleasant City	Mr. John F. Secrest.
Pleasant Hill	Mr. A. S. Bausman.
Pleasant Ridge	Mr. C. W. Acomb.
Pleasantville	Dr. W. E. Baker.
Plymouth	Dr. C. A. Overholt.
Poland	Dr. C. R. Justice.
Polk	Dr. W. H. Rhinehart.
Portage	Mr. T. Fasnaugh.
Port Jefferson	Dr. S. S. Crumbaugh.
Port Washington	Mr. M. W. Nargney.
Port Williams	Mr. S. L. Thorpe.
Powhatan Point	Mr. Franz Saner.
Proctorville	Dr. W. W. Reynolds.
Prospect	Mr. G. F. Gast.
Put-in-Bay	Mr. Adam Heidle.
Quaker City	Mr. J. W. Parker.
Quincy	Mr. G. B. Plummer.
Racine	Dr. C. N. Hayman.
Rarden	Dr. H. F. Clark.
Rawson	Mr. J. J. Hawk.
Ravenna	Mr. Lee W. Wood.
Reading	Mr. Riley Murphy.
Rendville	Dr. H. S. Cozad.
Republic	Dr. F. C. Gilcher.
Reynoldsburg	Dr. L. A. Parkinson.
Richwood	Mr. G. W. Morgan.
Ridgeway	Dr. E. B. Crow.
Ripley	Mr. G. M. Robb.
Rising Sun	Mr. Geo. W. Regon.
Rockford	Mr. O. Hedges.
Rochester	Dr. J. C. Dignan.
Rock Creek	Dr. W. S. Weiss.
Rocky Ridge	Mr. Wm. Schlegel.
Rogers	Mr. C. T. McArtor.
Roseville	Mr. G. B. Weaver.
Rushsylvania	Dr. J. G. Sutton.
Rushville	Dr. W. G. Lewis.
Salesville	Mr. W. E. McKinley.
Salineville	Mr. James Carter.
Sarahsville	Dr. W. S. Williams.
Scio	Mr. Jos. Wells.
Scott	Mr. Wm. Worthington.
Sebring	Mr. Walter S. Crewson.
Sedalia	Dr. E. B. Mead.
Senecaville	Mr. J. M. Rainie.
Seville	Dr. P. E. Beach.
Seven Mile	Mr. Henry Jacobs.
Shawnee	Dr. E. C. Mann.
Shelby	Dr. M. W. Bland.
Sharon	Mr. J. A. Reid.
Sherodsville	Dr. J. D. Aldridge.

Sherwood	Dr. H. C. Lindersmith.
Shiloh	Dr. S. S. Holtz.
Shreve	Mr. J. R. Wachtel.
Sidney	Mr. Wm. C. Wyman.
Smithfield	Dr. Wm. H. Wood.
Smithville	Dr. D. H. Morgan.
Somerset	Dr. O. L. Iden.
Somerville	Mr. L. W. Randall.
South Bloomfield	Dr. C. E. Blacker.
South Charleston	Dr. Thomas G. Farr.
South Lebanon	Mr. Geo. W. Snook, Clerk.
South Point	Dr. James Black.
South Salem	Dr. E. C. Lumbeck.
Sparta	Mr. S. G. Fowl.
Spencerville	Mr. Fred Hirn.
Springborough	Mr. John B. Blake.
Spring Hills	Mr. Quincey T. Eleyet.
Spring Valley	Mr. Arch Copsey.
St. Bernard	Mr. Henry J. Nailor.
St. Clairsville	Dr. D. L. Walker.
St. Marys	Dr. B. E. Thomas.
St. Paris	Dr. C. A. Offenbacher.
Stewart	Mr. G. H. Hawk.
Stockport	Mr. M. C. Riley.
Strasburg	Dr. J. C. Schultzbach.
Stouts	Dr. S. B. Grimes.
Stryker	Dr. C. F. Mignin.
Summerfield	Mr. A. G. Wharton.
Sugar Grove	Dr. S. Renshaw.
Sunbury	Dr. G. H. Gerhardt.
Swanton	Mr. Frank Minnick, Clerk.
Sycamore	Dr. W. H. Wickman.
Sylvania	Mr. Geo. A. Crandall.
Tarleton	Mr. J. B. Grove.
Tippecanoe City	Mr. C. R. Moser.
Tiro	Dr. W. H. Guiss.
Thornville	Dr. W. T. Stevens.
Thurman	Dr. Gomer E. Jones.
Tontogany	Mr. R. J. Collin, Mayor.
Toronto	Mr. Thomas Brown.
Trimble	Dr. H. D. Danford.
Trinway	Mr. LeRoy Rose.
Tuscarawas	Mr. M. A. Romig, Mayor.
Union City	Dr. Wm. M. Grimes.
Unionville Center	Dr. C. O. McCune.
Uhrichsville	Dr. James A. McCollam.
Utica	Dr. G. W. Garrison.
Upper Sandusky	Dr. G. O. Maskey.
Vandalia	Dr. W. H. Rilev.
Vanlue	Dr. James L. Schrotz.
Van Wert	Dr. C. G. Church.
Vermillion	Mr. B. S. Horton.
Versailles	Dr. C. F. Ryan.
Vinton	Mr. Joel A. Pugh.

Wadsworth	Dr. C. N. Lyman.
Waldo	Dr. J. R. Hipple.
Wapakoneta	Mr. A. Kohler.
Warsaw	Mr. S. W. Willis.
Washington	Mr. S. B. Lawrence.
Washingtonville	Mr. Wm. Holt.
Waterville	Dr. Samuel Downs.
Wauseon	Mr. D. C. Teeter.
Waverly	Mr. James J. Emmitt.
Waynesburg	Dr. E. G. McCormick.
Waynesfield	Mr. F. M. Berry.
Waynesville	Dr. H. Q. Alexander.
Webster	Mr. J. F. Byrd.
Wellington	Dr. R. G. Holland.
West Alexandria	Mr. R. C. Hill.
West Cairo	Dr. Geo. W. Henderson.
West Carrollton	Mr. James B. Manly.
West Elkton	Dr. Elwood Holaday.
Westerville	Mr. James D. Budd.
Western Star.....	Mr. Fred Becker.
West Jefferson	Mr. W. R. Borland.
West Leipsic	Mr. M. L. Pritchard.
West Liberty	Dr. R. M. Fulwider.
West Manchester	Mr. E. M. Wysong.
West Mansfield	Dr. C. W. Albright.
West Milton	Dr. Gainor Jennings.
West Park	Mr. W. L. Nichols, Clerk.
West Salem	Dr. D. W. Carver.
Weston	Dr. J. W. Williams.
West Union	Dr. W. K. Coleman.
West Unity	Mr. J. H. Tiddler.
Wharton	Mr. A. E. Baker.
White House	Mr. W. K. Jones.
Wilkesville	Dr. E. M. Dixon.
Williamsburg	Mr. C. P. Chatterton.
Williamsport	Mr. C. D. Briner.
Windham	Mr. H. J. Higley.
Willoughby	Dr. George B. Durban.
Willshire	Mr. S. K. Christy.
Wilmington	Dr. A. T. Quinn.
Winchester	Mr. Alfred Johnson.
Winton Place	Mr. G. C. Wildman.
Woodsfield	Mr. A. S. Baker.
Woodstock	Mr. Oliver Ewing.
Woodville	Mr. F. L. Nieman.
Worthington	Dr. D. H. Welling.
Wyoming	Mr. George Stoddard.
Yellow Springs	Dr. W. M. Haffner.
Zanesfield	Dr. C. M. Wanzer.
Zoar	Mr. Charles J. Breymaier.



ANNUAL REPORTS
OF
Local Boards of Health
FOR THE
YEAR ENDING DECEMBER 31, 1900.

ANNUAL REPORTS OF LOCAL BOARDS OF HEALTH.

OHIO STATE BOARD OF HEALTH.

OFFICE OF THE SECRETARY.

COLUMBUS, OHIO, December 31, 1900.

To the Health Officer:

DEAR SIR:—Will you please furnish the State Board of Health with a report of the operations of your board of health during the year ending December 31, 1900?

We wish to know particularly the present sanitary condition of your city or village, and whether your board has maintained an active organization and been successful in enforcing proper measures for the prevention of contagious disease and the abatement of nuisances.

Kindly use the blank space following for your report, being as brief as clear statements will allow.

The following points are suggested:

Sanitary Condition.—Are streets, alleys and yards in a cleanly condition? Is there cause for complaint from the lack of sewerage, or from an improper discharge of sewage? Are there nuisances which the board has unsuccessfully tried to abate? If so, what is their nature? What arrangements are made for the removal and disposition of night soil and garbage?

Contagious Diseases.—Are contagious diseases properly reported? Is a record of such diseases kept? Has the board been able to enforce proper restrictive measures? What contagious diseases have been more prevalent than usual? Give estimated number of persons vaccinated during the year? Please ascertain from superintendent of schools, if possible, and state the number of unvaccinated children attending public and parochial schools.

The Board of Health.—How many meetings has the board of health held during the year? Give total amount spent by board of health during the year. Give the number, character and results of any prosecutions brought by the board of health for violations of its orders of health laws.

Please return your report at the earliest possible time, in order that it may be included in the next annual report of the State Board of Health.

Very respectfully,

C. O. PROBST, M. D.,

By order of the Board.

Secretary.

ANNUAL REPORTS OF LOCAL BOARDS OF HEALTH.

ADA, HARDIN COUNTY.

W. H. Morrow, health officer.

Population (estimated), 3,000.

Streets, alleys and yards are in a cleanly condition.

The town has plenty of sewerage. Night soil is hauled out and buried. No provision is made by the city for disposal of garbage.

Contagious diseases are promptly reported when there are such, and a record kept, but none have occurred during the past year. About 200 of the 600 children attending school are unvaccinated.

Our board has held six meetings during the year. Forty dollars is the total amount spent by the board during the year. No prosecutions were necessary, as there were no violations of the rules of the board.

ADDYSTON, HAMILTON COUNTY.

Hugh Kennedy, health officer.

Population (estimated), 1,800.

Physicians generally report contagious diseases promptly, but they have to be shaken up occasionally. During the smallpox scare all the school children were vaccinated.

The board has met four times and expended during the year about \$95.00.

Infectious diseases reported during the year: Diphtheria, 3 cases; typhoid fever, 2 cases; whooping cough, 2 cases.

AKRON, SUMMIT COUNTY.

Dr. A. A. Kohler, health officer.

Population (estimated), 50,000.

Streets, alleys and yards are in a cleanly condition, and there is no complaint from lack of sewerage or improper discharge of sewage. All nuisances have been properly abated.

Night soil is removed by contract, at \$2.50 per cubic yard, paid for by the individuals. The garbage is removed by garbage company, who furnish airtight cans twice a week for fifteen cents a week, charged to individuals.

Contagious diseases are promptly reported and a record kept. The board has enforced restrictive measures. Diphtheria has been more prevalent than usual. The superintendent of our public schools is so busy that he thinks it would be impossible for him to look up the records in regard to vaccination. I think the children are pretty well vaccinated, however.

The board held twelve meetings. Sixty-five hundred dollars were expended for a smallpox hospital and \$2,200.00 for salaries, printing, etc.

Infectious diseases reported during the year: Diphtheria, 66 cases; membranous croup, 6 cases; scarlet fever, 28 cases; typhoid fever, 10 cases; whooping cough, 5 cases; measles, 4 cases.

ALGER, HARDIN COUNTY.

U. P. L. Vermillion, health officer.

Population (estimated), 625.

Streets, alleys and yards are as clean as could be expected at this time of year. No complaint in regard to sewerage. There have been no reports of any nuisances. Night soil arrangements are good, for a village of this size.

Contagious diseases have all been reported.

There were about three hundred persons vaccinated during the year.

The board holds regular monthly meetings. The expenses of the board during the year were \$23.18. No prosecutions were brought.

Infectious diseases reported during the year: Smallpox, 51 cases.

ALLIANCE, STARK COUNTY.

P. W. Welker, M. D., health officer.
Population (estimated), 9,000.

Infectious diseases reported during the year: Diphtheria 8 cases; scarlet fever, 11 cases.

Not a case of contagious disease has been reported to this office the past year.

About 90 per cent. of school children are not vaccinated.

The expenses of the board will not exceed \$5.00 for the past year.

ANNA, SHELBY COUNTY.

Dr. C. W. B. Harbour, health officer.
Population (estimated), 900.

Sanitary condition of our village good. No arrangement made for removal of night soil.

Contagious diseases are not reported always. A record is kept of all cases reported. There are about 160 unvaccinated children attending school.

No meetings of board were held. No prosecutions were brought this year.

ARCANUM, DARKE COUNTY.

E. B. Hawley, health officer.
Population (estimated), 1,600.

The streets, alleys and yards are in a cleanly condition. No cause for complaint on account of lack of sewerage. There is no nuisance which the board has failed to abate. We have a man who attends to removal of night soil at night and of garbage, which is buried very deep.

All contagious diseases are reported promptly and a record is kept. I don't think there are 25 vaccinated children in our village.

We have had six meetings during the year. I think we have one of the nicest and cleanest villages in Ohio. The people delight in keeping their premises clean.

Infectious diseases reported during the year: Membranous croup, 6 cases; scarlet fever, 3 cases; typhoid fever, 37 cases; whooping cough, 5 cases; measles, 2 cases.

ANSONIA, DARKE COUNTY.

Dr. H. A. Snorf, health officer.
Population (estimated), 676.

Streets, alleys and yards in cleanly condition. We need sewerage, and need it badly. The board abated a nuisance caused by a filthy pig pen. Night soil removed by wagons to country.

Contagious diseases are reported but no record is kept. The board enforces restrictive measures. No vaccinations.

Board has met about half a dozen times. Have spent about \$50.00. No orders have been violated.

ARCHBOLD, FULTON COUNTY.

August Ruihley, health officer.
Population (estimated), 1,000.

Streets and alleys are in fair condition. Our main nuisance, that is, our open railroad ditch, will be sewered the coming summer. The night soil is carted out of town.

Contagious diseases are now generally reported. School pupils are nearly all vaccinated. Our board of health ordered compulsory vaccination last spring. Since enforcing strict quarantine, contagious diseases are confined in the house in which they originate.

Board of health met only twice. It is almost impossible to get a quorum.

ARCADIA, HANCOCK COUNTY.

F. L. Smart, health officer.
Population (estimated), 450.

The sanitary condition of our village is ordinarily good. When I took the office two years ago, the alleys and privy vaults were all full, but I cleaned them up, and the citizens have not waited for me to notify them again, as they well know that I intend keeping things clean. So the cause for complaint is reduced to a minimum.

There was about \$40 spent by the health board and health officer this year.

Infectious diseases reported during the year: Scarlet fever, 1 case; typhoid fever, 6 cases.

ARLINGTON, HANCOCK COUNTY.

W. D. Sebastian, health officer.

Population (estimated), 800.

Streets and alleys fairly clean. Yards clean. Sewerage fairly good. Night soil buried.

Out of 14 cases of typhoid fever one case was reported.

The board of health meets twice each month.

Infectious diseases reported during the year: Scarlet fever, 4 deaths; whooping cough, 2 deaths. Total number infectious diseases, 48 cases.

ASHLEY, DELAWARE COUNTY.

Dr. H. N. Coomer, health officer.

Population (estimated), 700.

The present sanitary condition of our village is not good. We have no legally organized board of health to support and direct proper measures for the prevention of infectious and contagious diseases, and the abatement of nuisances. I have insisted upon the importance of a board of health being appointed by our village council, but have signally failed to get a quorum of the members together for the purpose.

I have successfully abated all the nuisances reported to me, except one which required the action of the council to establish and open a water-course. This, however, was ignored by the council. There are no arrangements made for the disposition of night soil and garbage.

Contagious and infectious diseases are not properly reported — sometimes not reported (and then verbally) until several days after diagnosis is confirmed.

The sanitary condition of our public schools is good. One hundred and eighty of the one hundred and ninety-seven children attending school are unvaccinated.

We need an efficient board of health and its accessories to successfully repel the invasion of unsanitary conditions which may at any time arise.

Infectious diseases reported during the year: Scarlet fever, 7 cases; typhoid fever, 21 cases; measles, 1 case.

ASHVILLE, PICKAWAY COUNTY.

John Johnson, health officer.

Population (estimated), 800.

Infectious diseases reported during the year: Typhoid fever, 4 cases.

ATHENS, ATHENS COUNTY.

Dr. J. M. Higgins, health officer.

Population (estimated), 4,000.

The streets and alleys of Athens are in a cleanly condition. The sewerage system is very fine and there are no complaints from that source. Board has been able to promptly abate all nuisances.

The contagious diseases that are reported by the physicians are smallpox, scarlet fever, diphtheria, and membranous croup. A record is kept of the above named diseases. The board has been able to enforce restrictive measures. Whooping cough has been more prevalent than usual. Compulsory vaccination was ordered by the board of all school children in September and all schools closed for 10 days. All children in school but 31 (whom it was considered dangerous to vaccinate on account of latent constitutional diseases) were vaccinated, 650 in all. The per cent. of successful vaccinations I presume was about eighty.

The board has held perhaps thirty meetings during the year. The expense account of the board for the year, not including salaries of officers (\$245), was not in excess of \$25.

There is no probability of an epidemic of any serious nature in Athens while the present very complete system of sewerage is maintained. During the summer just passed the sewerage sys-

tem has been extended so that now there is hardly a street or alley that is not supplied with a sewer. Every water closet and sink in the town that could be was compelled to connect with the sewer. The water system is splendid. The four cases of smallpox that developed here caused almost consternation for a short time, but prompt and thorough quarantine and compulsory vaccination by the board of health and its officers nipped a threatened epidemic in the bud.

Infectious diseases reported during the year: Smallpox, 4 cases; diphtheria, 1 case; scarlet fever, 1 case.

ATTICA, SENECA COUNTY.

Dr. C. A. Force, health officer.

Population (estimated), 1,000

The sanitary condition of the village is good. We take great pains to keep the streets and alleys clean.

Had quite an epidemic of whooping cough during the summer. There are about 125 unvaccinated children attending school.

The board meets as necessary to transact business.

Infectious diseases reported during the year: Scarlet fever, 1 case; whooping cough, 21 cases.

BAKERSVILLE, COSHOCTON COUNTY.

Dr. J. D. Lower, health officer.

Population (estimated), 200.

Infectious diseases reported during the year: typhoid fever, 5 cases; whooping cough, 10 cases.

BARBERTON, SUMMIT COUNTY.

Dr. F. Lahmers, health officer.

Population (estimated), 4,400.

Streets, alleys and yards are kept in good sanitary condition. Some complaint from improper discharge of sew-

ers and lack of sewerage. Nuisances were all successfully abated with exception of one or two. Garbage and night soil is removed to dumping grounds outside of city limits.

Contagious diseases are properly reported and record kept of the same. Board has enforced proper restrictive measures. Typhoid fever has been more prevalent than usual.

The number of persons successfully vaccinated is 288.

Number of unvaccinated children attending school is 444.

Board has held 16 meetings the past year. Total amount of money spent by board during the year was \$485.45. No prosecutions were brought by the board for violation of law.

Infectious diseases reported during the year: Diphtheria, 3 cases; membranous croup, 3 cases; scarlet fever, 8 cases; typhoid fever, 12 cases; measles, 4 cases.

BARNESVILLE, BELMONT COUNTY.

W. A. Talbott, health officer.

Population (estimated), 3,800.

Our town is in fairly good sanitary condition. We have no nuisances that we cannot abate. Night soil is removed and buried on a lot in the country provided for that purpose.

Contagious diseases are promptly reported, excepting typhoid fever.

The board has maintained an active organization and meets monthly during the winter and twice a month during the summer.

The board has spent \$125.00 for sanitary purposes. There have been three prosecutions during the year—all for the improper removal of night soil.

BEAVERDAM, ALLEN COUNTY.

J. B. Haines, M. D., health officer.

Population (estimated), 600.

The sanitary condition of our village is good, including streets, alleys and

yards. There has been no attempt to abate nuisances during the year. No special arrangements are made for the removal or disposition of night soil and garbage.

The board of health is active in enforcing proper measures for the prevention of contagious diseases, which are properly reported, and record kept of the same. We have had no contagious diseases except one case of measles and nine cases of smallpox. This is the first time that smallpox ever gained admittance into our village. In a short time it developed in three houses. These houses are close together and the families visited each other frequently. It has not spread any for a period of five weeks, and all are nearly well. These homes are held under strict quarantine. The superintendent of schools reports about 60 pupils unvaccinated.

The board has had about 10 or 12 meetings during the year.

The board of health has spent about \$65.00, but are not through with expenditures in smallpox cases. There have been no prosecutions for violations of its orders or health laws.

Infectious diseases reported during year: Smallpox, 9 cases; measles, 1 case.

BEDFORD, CUYAHOGA COUNTY.

C. W. Kerslake, health officer.

Population (estimated), 1,600.

The present sanitary condition of the village is good and the board has used proper measures to prevent the spread of contagious diseases and for the abatement of nuisances. The streets in wet weather are in bad shape. We have no sewerage at all. Night soil and garbage is buried.

Contagious diseases are reported and a record is kept. The board has done all in its power to enforce restrictive measures. Whooping cough has been more prevalent than usual. There are about 100 unvaccinated children attending school.

The board held twelve meetings during the year. About \$75.00 was spent by the board. There were no prosecutions.

Infectious diseases reported during the year: Diphtheria, 2 cases; scarlet fever, 2 cases; typhoid fever 1 case; whooping cough, 3 cases.

BELLAIRE, BELMONT COUNTY.

D. W. Boone, M. D., health officer.

Population (estimated), 10,000.

Sanitary condition good. Sewerage system is being improved every year, but there is plenty of room for further improvement. The health board has abated all nuisances undertaken. Night soil is removed by private contract, out of corporation to a low bottom where holes are dug and night soil dumped in. Garbage is hauled to same bottom.

Contagious diseases are properly reported and a record is kept. The board has been able to enforce proper restrictive measures. Typhoid fever and whooping cough have been more prevalent than usual. I do not think there were more than fifteen or twenty vaccinated during the year. The superintendent of schools does not know how many of the children are unvaccinated. The health board offered to vaccinate gratuitously, but no one came to be vaccinated. I have urged the school board to enforce vaccination, but they take no action in the matter. I wish it was compulsory throughout the State, and that the board of health and school board had nothing to do with the matter. We will never have universal protection from smallpox until we have a change in the laws.

The board of health held four meetings and expended during the year \$400.00. Four persons were brought before the court and fined for not removing night soil, one for keeping a dirty slaughter house, and one for burying a horse within the corporation limits.

Infectious diseases reported during the year: Diphtheria, 8 cases; mem-

braneous croup, 8 cases; scarlet fever, 29 cases; typhoid fever, 231 cases; whooping cough, 177 cases; measles, 86 cases.

BELLBROOK, GREENE COUNTY.

G. H. Lamb, health officer.

Population (estimated), 425.

Streets and alleys are clean. No cause for complaint on account of sewerage. No nuisances of any kind now. Garbage hauled away by town authorities.

All contagious diseases have been properly reported. We have had no contagious diseases in the town proper during the year. Some cases of scarlet fever near the town were closely quarantined at our suggestion and did not spread into the town. Many of our children have not been vaccinated.

Our board of health has met about twelve or fifteen times during the year. It is duly organized and ready for careful and effective work. We have not spent any money, and have not had any cases of prosecution for violation of our orders.

We expect to be more careful in the future and look more particularly after all impure water, etc.

BELLEVUE, HURON COUNTY.

Fred R. Hancock, health officer.

Population (estimated), 4,000.

The streets and alleys are kept in good condition. Sewerage is not a great success, owing to catch-basin getting full and board not compelling same to be cleaned. Night soil and garbage is removed in barrels at expense of property owners. Have tried to prevent moving of same during daytime or hot weather, but local board of health will not back me, so it is a go-as-you-please.

Contagious diseases have been reported the last eight months and a record is kept. Board has not enforced restrictive measures in all cases. Scarlet fever and smallpox were prevalent

last spring. There were about 250 persons vaccinated. About 150 unvaccinated children are attending school.

There were eleven meetings of the board. The expenditures amounted to \$533.42. There were no prosecutions.

Infectious diseases reported during the year: Smallpox, 11 cases; diphtheria, 2 cases; membranous croup, 4 cases; scarlet fever, 77 cases; typhoid fever, 17 cases; whooping cough, 15 cases; measles, 4 cases.

BELMONT, BELMONT COUNTY,

David S. Pierce, health officer.

Population (estimated), 550.

Sanitary condition good. There have been no contagious diseases and no deaths.

The board of health held one meeting. The board is not doing anything. The council think we do not need a board of health. They will not pay any bills and are continually fighting the board.

BETHEL, CLERMONT COUNTY.

Julius D. Abbott, M. D., health officer.

Population (estimated), 1,250.

Our streets and alleys are very well kept for a village. The sewerage could be greatly improved, doubtless will be in the near future. There are no nuisances left unabated. The board is generally willingly obeyed. Night soil and garbage is generally buried.

The getting a full report of contagious diseases has caused much trouble and some hard feelings between officers and physicians. Record of such is kept. Restrictive measures are well observed, but, as suggested in last report, a small town with board of health, no matter how effective, will not get along so long as the townships outside such corporation have no health officer except township trustees. They are too slow to act. We have not vaccinated any nor ordered it done. I cannot report number of unvaccinated children. With

exception of two or three diphtheria cases early in year we have had no contagious diseases.

The rules of the board provide that it shall meet monthly. Amount spent by board about \$95.00. No prosecutions.

BEVERLY, WASHINGTON COUNTY.

Joseph E. Hall, health officer.

Population (estimated), 800.

Sanitary condition good. No cause for complaint on account of sewerage.

Contagious diseases were properly quarantined and no further cases developed from them. Unvaccinated children in public school, 84.

Board held one meeting. There was no money spent.

Infectious diseases reported during the year: Diphtheria, 1 case; scarlet fever, 2 cases; typhoid fever, 3 cases; whooping cough, 24 cases.

BLANCHESTER, CLINTON COUNTY.

Dr. S. B. Judkins, health officer.

Population (estimated), 2,000.

I report our village in fair condition. The streets and alleys are not what they should be. The board has been obeyed. Night soil and garbage is hauled away.

Contagious diseases are reported and record on postal card kept. Nearly all children have been vaccinated.

The board has regular meetings since July 20, 1899. The expenses of board have been nothing. No suits.

BLOOMINGBURG, FAYETTE COUNTY.

L. Dellinger, health officer.

Population (estimated), 800.

Infectious diseases reported during the year: Typhoid fever, 2 cases; measles, 3 cases; mumps, 2 cases.

BOND HILL, HAMILTON COUNTY.

D. E. Murphy, health officer.

Population (estimated), 1,400.

Village in good sanitary condition.

Infectious diseases reported during the year: Diphtheria, 1 case; whooping cough, 8 cases; measles, 10 cases.

BOWERSVILLE, GREENE COUNTY.

S. A. Bowermaster, health officer.

Population (estimated), 450.

The sanitary condition of the town is good. Streets and alleys in fair condition. Night soil is buried in village.

All contagious diseases are reported. Number of children attending school not vaccinated 74.

Board has met three times during the year.

BOWLING GREEN, WOOD COUNTY.

A. Ordway, health officer.

Population (estimated), 5,067.

Infectious diseases reported during the year: Diphtheria, 13 cases; membranous croup, 3 cases; scarlet fever, 19 cases; typhoid fever, 29 cases; measles, 9 cases.

BRADNER, WOOD COUNTY.

J. C. Duffield, health officer.

Population (estimated), 1,100.

The sanitary condition of our village is at present good. An active organization has been kept up and we have been successful in enforcing all measures. Streets and alleys in good condition. Garbage is removed in wagons. Board has been able to enforce all restrictive measures.

The board meets once a month.

Infectious diseases reported during the year: Scarlet fever, 3 cases; typhoid fever, 8 cases; measles, 3 cases.

**BRIDGEPORT, BELMONT
COUNTY.**

Dr. V. Wagener, health officer.

Population (estimated), 3,969.

Streets and alleys in good condition. Sewerage system splendid. Night soil is buried.

Contagious diseases are not all reported. Board enforces all restrictive measures. There are no records kept of vaccination. Superintendent of schools requires the children to be vaccinated.

The board of health meet only when called. One person was prosecuted for cleaning vault in day time and not hauling it away but washing it in the sewer.

Infectious diseases reported during the year: Smallpox, 1 case; diphtheria, 6 cases; membranous croup, 8 cases; scarlet fever, 12 cases.

**BROOKLYN, CUYAHOGA
COUNTY.**

Wm. Treat, health officer.

Population (estimated), 3,000.

The town is in fairly good sanitary condition. We have poor conditions for sewerage, but the coming summer will enable the village council to build a contemplated sewer system. No nuisances. Night soil is removed by sanitary police.

Contagious diseases are properly reported by resident physicians, but some from the city of Cleveland are not altogether satisfactory. We have kept no record of contagious diseases during the past year, but one will be kept in future. The board has been able to enforce restrictive measures. Diphtheria and typhoid fever have been more prevalent than usual. There are 261 unvaccinated children attending school.

The board held eleven meetings during the year. The amount spent was \$172.20.

Infectious diseases reported during the year: Smallpox, 1 case; diphtheria, 12 cases; scarlet fever, 3 cases; typhoid fever, 6 cases.

**BROOKVILLE, MONTGOMERY
COUNTY.**

Dr. U. Z. Miller, health officer.

Population (estimated), 850.

Generally speaking the alleys and back yards are not in a cleanly condition. There is no cause for complaint from lack of sewerage, but some cause for complaint from improper discharge of sewage. The board has been, generally speaking, successful in abating nuisances. As yet, there are no arrangements for the removal or disposition of night soil or garbage by the board of health. The property owners dispose of it at their own pleasure or when ordered so to do by the board.

Contagious diseases are not properly and promptly reported by one physician only. A partial record of contagious diseases is kept. When the board has been notified of any contagious disease they have been able to enforce proper restrictive measures. Scarlet fever and chickenpox have been the most prevalent diseases the last year. No one has been vaccinated during the last year. There are now one hundred and seven pupils attending public school who are unvaccinated.

The board of health has held only three meetings during the year and have spent about fifty dollars. There have been no prosecutions but quite a number of notices have been served under the "nuisance" ordinance and all have been complied with, without prosecution.

Infectious diseases reported during the year: Scarlet fever, 6 cases; typhoid fever, 1 case; measles, 3 cases; other infectious diseases, 6 cases.

BRYAN, WILLIAMS COUNTY.

Nicholas Vineyard, health officer.

Population (estimated), 3,500.

The town of Bryan is in a neat, cleanly condition. All nuisances are promptly abated.

All contagious diseases are promptly reported by the attending physician and

houses quarantined. A record is kept of all contagious diseases.

Board of health has stated times for meetings, but only meets when urgent necessity demands their presence. There were no violations of health laws. Annual expenses of board of health about \$135.

Infectious diseases reported during the year: Scarlet fever, 5 cases; typhoid fever, 9 cases.

BUCYRUS, CRAWFORD COUNTY.

Dr. W. A. Daugherty, health officer.

Streets, yards, etc., are looked after by sanitary police and street commissioner and kept in good condition. Our sewerage system gives very good satisfaction. Board has abated all nuisances. Garbage is removed by wagons and carts outside the corporation. Night soil is removed in closed barrels during summer at night, and winter mostly in day time, to dumping grounds outside the city and buried.

Contagious diseases are properly reported and a record made of them. All orders of the Board are enforced. Measles has been the prevailing disease during the year. No record is kept of those vaccinated but more have been vaccinated than during the previous year.

The board has held one meeting each month during the year. Could not give amount spent by the board.

Two persons were brought before the authorities for violating the rules of the board, pleaded guilty and were fined.

Infectious diseases reported during the year: Membranous croup, 1 case; scarlet fever, 7 cases; typhoid fever, 38 cases; chicken pox, 5 cases; mumps, 12 cases; measles, 245 cases.

BURBANK, WAYNE COUNTY.

A. W. Hoffman, health officer.

Population (estimated), 400.

Streets, alleys and yards are in good condition. There is no complaint on account of sewerage or drainage.

Contagious diseases are not reported as promptly as they should be. There are about 55 unvaccinated children attending school.

The board of health has not been properly organized for a year, and only two meetings were held, all of the members not being present at these. The board incurred no expenses during the year.

BURTON, GEAUGA COUNTY.

Dr. B. F. Ray, health officer.

Population (estimated), 800.

Streets, alleys and yards are in a cleanly condition. Sewerage good. We are on a hill to our advantage. All nuisances have been abated.

Contagious diseases are reported, and the board enforces restrictive measures. Smallpox and scarlet fever have been more prevalent than usual. There are fifty unvaccinated children attending school.

Six meetings of the board were held. No prosecutions were brought.

Infectious diseases reported during the year: Smallpox, 4 cases.

BUTLER, RICHLAND COUNTY.

E. G. Rummel, M. D., health officer.

Population (estimated), 600.

The streets, alleys and yards of this village at present are in fair condition, with the exception of one or two alleys. We have no sewerage system here. Night soil and garbage is removed by owner of property.

Have not had any contagious diseases during past year. I only know of one vaccination during past year (that was myself.)

Unvaccinated children in schools, about 70.

Board of health meet monthly. Expenses, \$43.00. There have been no prosecutions.

CALDWELL, NOBLE COUNTY.

Dr. A. I. Andrus, health officer.

Population (estimated), 900.

Our town is in a good healthy condition. I think it is kept as clean as any place of its size in the State. Our sewerage is fair. Streets, alleys and lots, clean and kept clean.

We have not had a contagious disease within our corporation within the past year to my knowledge. We aim to keep a record of them.

We have had 7 or 8 meetings, I think, within the past year and expended something over a hundred dollars.

CALEDONIA, MARION COUNTY.

Noah Lee, health officer.

Population (estimated), 800.

Our streets, alleys and yards have been carefully looked after and kept in a good sanitary condition. Our mayor and members of the health board made several personal tours through the village in a body inspecting the streets, alleys, etc., having a very good effect, we think.

We have no cause for complaint on account of lack of sewerage and have abated all nuisances without trouble. Our night soil and garbage is removed in late evenings, or early morning and buried.

The contagious diseases have been reported promptly by our physicians, and a record kept of same. We have had no one contagious disease more prevalent than another. I could not tell how many children attending our schools have been vaccinated.

We have had five regular meetings during the year. We have been at no expense during the year other than the health officer's and clerk's salaries, excepting 40c expended for blank reports from the physician to the health officer. Had no occasion to prosecute for violating orders or health laws.

Infectious diseases reported during the year: Diphtheria (mild form), 1 case; typhoid fever, 1 case; measles, 1 case.

CAMBRIDGE, GUERNSEY COUNTY.

I. A. Oldham, health officer.

Population (estimated), 9,500.

The sanitary condition of the city is good. Streets, alleys and yards are kept free from garbage and litter. Sewerage system is good, and the discharge from same is not an annoyance to those residing near the outlet, or cause for complaint by people on the stream below. The board has been successful in abating nuisances. Night soil is removed in tight barrels to a farm adjoining the city and plowed under.

Garbage is disposed of on city dump. Contagious diseases are properly reported and record kept of same. Quarantine orders are promptly obeyed. Typhoid and scarlet fever have been the most prevalent diseases. Less than three hundred in an enrollment of near eighteen hundred school children have been vaccinated.

The board has held during the year seven meetings. Amount expended, \$584.41. Three prosecutions were brought during the year, one for violating quarantine and two for permitting a nuisance.

Infectious diseases reported during the year: Diphtheria, 5 cases; membranous croup, 4 cases; scarlet fever, 29 cases; typhoid fever, 24 cases; whooping cough, 1 case; measles, 94 cases; other infectious diseases, 9 cases.

CANAL DOVER, TUSCARAWAS COUNTY.

H. Breitenstine, health officer.

Population (estimated), 5,422.

Streets and alleys are clean.

Contagious diseases are not reported as they should be. Diphtheria has been most prevalent.

We had seven meetings of the board. Total expenses of the board, \$64.00.

Infectious diseases reported during the year: Diphtheria, 27 cases; scarlet fever, 11 cases, typhoid fever, 3 cases.

CANAL FULTON, STARK COUNTY.

George Becker, health officer.

Population (estimated), 1,400.

Streets, alleys and yards are in good condition. We have good sewerage. No nuisances.

Each family takes care of their night soil and garbage. Contagious diseases are always reported, and a record kept. The board enforces all restrictive measures. As near as the teachers know the children are all vaccinated.

About twenty have been vaccinated this last year. There being no contagious diseases the board did not meet except when I was elected health officer.

About \$20.00 was spent for sanitary purposes during the year. No prosecutions were necessary.

CANAL WINCHESTER, FRANKLIN COUNTY.

W. S. Gayman, M. D., health officer.

Population (estimated), 700.

Streets, alleys and yards are in a cleanly condition. All nuisances have been abated without trouble.

No children were vaccinated during the last year.

Health board meets every third Monday night of month. The board spent \$75.00 during the year.

CANFIELD, MAHONING COUNTY.

A. D. Wood, health officer.

Population (estimated), 672.

Streets, alleys and yards are in a sanitary condition. There is a tile laid in the low part of the village designed for draining cellars, but the people have placed catch basins along the line and empty refuse matter into it and this on being deposited at the end of the drain causes a stench, which has been and is the cause of much complaint. The board has taken very little action to abate same. Each person removes their own night soil.

Contagious diseases are properly reported but only an imperfect record is kept. Restrictive measures have been enforced. Measles has been more prevalent than usual. I do not know of any vaccinations having been performed, and the superintendent of schools is unable to furnish the number of unvaccinated school children.

The board held four meetings, and expended \$12.00. There were no prosecutions brought.

Infectious diseases reported during the year: Scarlet fever, 2 cases; typhoid fever, 3 cases; measles, 9 cases.

CANTON, STARK COUNTY.

J. F. Marchand, M. D., health officer.

Population (estimated), 40,000.

The streets, alleys and yards are kept in a cleanly condition under direction of our sanitary policeman. We need our sewer mains and laterals extended. The discharge of sewage is perfect. Precipitation method is used. No unsuccessful attempt to abate nuisances. The board of health has no arrangement as a board for removal of night soil and garbage. The people arrange for that themselves, but the persons who haul same away, are known to the board and kept under supervision for safe deposit of same.

Contagious diseases are properly reported, and a record of same is kept. All restrictive measures have been enforced. Diphtheria has been the most prevalent contagious disease. We stamped out smallpox with a start of 16 cases by enforcing strict quarantine. Only 9 deaths from membranous croup and 5 deaths from diphtheria. Don't know how many persons have been vaccinated during past year. Cannot estimate number of unvaccinated children in our schools.

There have been 8 meetings during the year. Expended by the board during the year in salaries of officers of the board, \$3,480. There have been no prosecutions.

ecutions during the year for violation of orders or health ordinances.

Infectious diseases reported during the year: Smallpox, 16 cases; diphtheria, 110 cases; membranous croup, 12 cases; scarlet fever, 8 cases.

CARDINGTON, MORROW COUNTY.

H. Van Horn, health officer.

Population (estimated), 1,400.

The streets, alleys and yards have been maintained in a cleanly condition. Sewerage good by natural location of village. Nuisances in general are successfully abated. Garbage is deposited outside of corporation limits. Night soil deposited on land.

Contagious diseases have been properly reported and the village has been exceptionally free from the general infectious diseases. Have not had a case of scarlet fever this year, compared to twenty-six cases in foregoing year. No measles inside of corporation limits, and only one case of smallpox, which was successfully quarantined and confined to one case.

A number of cases of chickenpox are reported, but all of mild form. There are a number of unvaccinated children in school—about 40 per cent. Number of persons vaccinated during the year, about 30.

The board has held four meetings during the last year and spent about one hundred dollars. Have had no prosecutions for violation of the orders of the board.

Infectious diseases reported during the year: Smallpox, 1 case; membranous croup, 1 case; typhoid fever, 5 cases; whooping cough, 4 cases; vari-cella, about 20 cases.

CAREY, WYANDOT COUNTY.

Dr. J. H. Ferrel, health officer.

Population (estimated), 2,000.

Streets, alleys and yards in good con-

dition. We have very poor facilities for sewerage, there being no proper discharge except a small brook through village, which we aim to keep in best sanitary condition possible. Been quite successful in abating nuisances, but perhaps were not as strict as we might have been. Our vaults are not up to the standard in sanitary regulation but expect to enforce the regulation more rigidly. We have a city dumping ground outside corporation and appoint a scavenger who keeps ground in order.

Diphtheria and scarlet fever have been properly reported, in regard to others, very negligent. Scarlet fever has been prevalent.

Board met 12 times in regular session. No prosecution.

Infectious diseases reported during the year: Membranous croup 1 case; scarlet fever, 19 cases; typhoid fever, 4 cases; whooping cough, not reported, five cases last year; measles 1 case; had few cases of mumps.

CARROLTON, CARROLL COUNTY.

Dr. A. H. Hise, health officer.

Population (estimated), 1,500.

The sanitary condition of our town is fairly good.

There have been no contagious diseases the past year. No record is kept. There have been no vaccinations, and it is impossible to give the number of vaccinated and unvaccinated school children, as this is vacation time.

There have been no meetings of the board the past year.

CARTHAGE, HAMILTON COUNTY.

J. G. Henderson, health officer.

Population (estimated), 3,500.

Streets and alleys are kept free from vegetable and animal matter. Have a garbage cart that collects weekly three times in summer and twice in winter. Have about 2,000 feet of sewer in the south part of the town. A sewer from

Longview Hospital crosses the village leading to Mill creek, tapped that at two places, and this will carry off much surface drainage. Night soil is buried on old farm lands outside of village. Garbage is dumped in old gravel pit near canal, on the boundary line of village. Contagious diseases reported and record kept. Have enforced restrictive measures in all cases. Not as many cases of contagion as in former years. The superintendent of schools reports the number of unvaccinated school children as small. The doctors report about the usual number of vaccinations.

The board has met but twice during my connection with it, since April 1, 1900. It is hard to get them out when there is nothing to cause alarm. The only expenditure has been for the salary of the health officer. There have been no prosecutions for violations of the law.

Infectious diseases reported during the year Diphtheria, 6 cases; membranous croup, 1 case; scarlet fever, 5 cases.

CATAWBA, CLARK COUNTY.

T. D. Beach, M. D., health officer.
Population (estimated), 300.

Streets and lots in fairly good condition. Not annoyed by sewage. Have been but little annoyed by nuisances. Complaint at times of live stock being kept too near homes.

Officially the disposal of night soil is neglected, but property holders are reasonably cleanly.

Have had no contagious diseases to deal with during past year.

None vaccinated so far as I know.

Board has held no meetings. No money used.

In truth we have had no business to attend to.

CECIL, PAULDING COUNTY.

S. E. De Muth, M. D., health officer.
Population (estimated), 350.

Sanitary conditions fairly good.

Contagious diseases are properly reported and records are kept. All measures are enforced. No disease has prevailed. Two hundred persons were vaccinated during year.

Board of health held 12 meetings About \$140 was spent during year. No prosecutions.

Infectious diseases reported during the year: Diphtheria, 6 cases; membranous croup, 2 cases; typhoid fever, 1 case.

CEDARVILLE, GREEN COUNTY.

D. H. McFarland, health officer.
Population (estimated), 1,700.
The sanitary condition is good.

We quarantine all contagious diseases as soon as reported by the attending physician. We have not kept a record of contagious diseases.

Scarlet fever has been prevalent. The board meets the first Tuesday of each month. Total amount spent by the board, \$100.00.

Infectious diseases reported during the year: Smallpox, 1 case; scarlet fever, 11 cases.

CELINA, MERCER COUNTY.

L. P. Lisle, M. D., health officer.
Population (estimated), 3,100.

Sanitary condition of our town not good.

Streets, alleys and yards in fair condition. We practically have no sewerage. Board does not receive the proper encouragement in the abatement of nuisances, and the prevention of contagious diseases.

We have endeavored to abate certain nuisances without success. Night soil is carted outside of the corporation and buried.

Contagious diseases are reported only in part.

A record of all reported is kept. The board has been able to enforce proper restrictive measures when possible.

Diphtheria most prevalent. No children vaccinated this year.

Board met 10 times during the year. Amount spent by board for the year, \$2.65.

No prosecutions brought by board for violations of orders this year.

Infectious diseases reported during the year: Diphtheria, 15 cases; membranous croup, 4 cases.

CENTERBURG, KNOX COUNTY.

J. C. Coe, health officer.

Population (estimated), 700.

The sanitary condition of our village is good. We have a well organized board and it has been successful in every way.

Infectious diseases reported during the year: Scarlet fever, 1 case; typhoid fever, 5 cases.

CHAGRIN FALLS, CUYAHOGA COUNTY.

W. J. Clark, health officer.

Population (estimated), 2,000.

Our streets, alleys and yards are in fairly clean condition. There is but very little complaint from lack of sewerage. Our village is so located that the heavy rains wash away nearly all filth. Night soil remains in out-houses until removed for fertilizer.

All contagious diseases are properly reported by the attending physician, and the health officer is required to keep a record of the same. The board has been able to enforce quarantine when necessary. We have no means of knowing how many persons have been vaccinated. No record is kept at the schools of the number of unvaccinated or vaccinated children.

The board of health meet once each month.

Infectious diseases reported during the year: Scarlet fever, 4 cases; measles, 1 case.

CHICAGO, HURON COUNTY.

Dr. R. N. Reynolds, health officer.

Population (estimated), 2,300.

The streets, alleys and yards are in a cleanly condition. There is cause for complaint from lack of sewerage. There are no nuisances which the board has unsuccessfully tried to abate. The night soil is removed by a wagon at night and disposed of.

The contagious diseases are properly reported. There is a record of such disease kept. The board has been able to enforce proper restrictive measures. Scarlet rash has been more prevalent than usual. None were vaccinated during last year, near as I can estimate.

About four meetings were held by board of health. The board of health spent \$55 during last year. We have not had any prosecutions brought by the board of health.

Infectious diseases reported during the year: Typhoid fever, 3 cases; measles, 2 cases.

CHICKASAW, MERCER COUNTY.

H. L. Schaefer, health officer.

Population (estimated), 500.

Streets and alleys are clean. No lack of sewerage. Contagious diseases are promptly reported. Record kept. Board enforces quarantine strictly. None vaccinated.

Board meets every month regular. Total amount spent by board \$50.00.

Infectious diseases reported during the year: Scarlet fever, 3 cases; typhoid fever, 1 case.

CHILLICOTHE, ROSS COUNTY.

F. M. Smallwood, M. D., health officer.

Population (estimated), 14,000.

Our streets, alleys and yards are in excellent condition. Only a part of our city is sewerred, possibly one-third.

The only nuisance which we have failed to abate is the *open well*, which I consider the source of all our typhoid. The

night soil is disposed of between the hours of 9 P. M., and 5 A. M., and the parties doing such work must have a license from our board and must have air-tight barrels and haul such excrement outside of the city limits and not near any running stream. We dispose of garbage by dividing city into districts. Each district has one cartman, whose duty it is to see that all alleys and streets in his section are kept clean. Garbage is hauled out of city limits if practicable, and if not, is burned or covered with earth.

All contagious diseases are reported and placed under such quarantine as your board directs, and a record of same is kept. We have no trouble in enforcing restrictive measures. Number of unvaccinated children attending school, 780.

Eighteen meetings were held during the year. Total amount spent, \$3,561.12. We have had no prosecutions.

Infectious diseases reported during the year: Diphtheria, 6 cases; membranous croup, 3 cases; scarlet fever, 23 cases; typhoid fever, 120 cases; whooping cough, 47 cases; measles, 20 cases; other infectious diseases, 25 cases.

CINCINNATI, HAMILTON COUNTY.

Clark W. Davis, M. D., health officer.

Population (estimated), 326,000 (census 1900.)

Death rate per 1000 population 16.60.

The sanitary condition of the city is good. There is no complaint on account of lack of sewerage or improper discharge of sewage. Night soil is dumped into Mill creek. Garbage is disposed of by the Simonan process.

Contagious diseases are properly reported and a record kept. Proper restrictive measures have been enforced in all cases. Scarlet fever has been more prevalent than usual. The estimated number of persons vaccinated during the year is 3500. No unvaccinated children are permitted to attend school.

The board of health is composed of the board of public service. They meet daily and receive any communication pertaining to the health of the city at any time. There were four cases prosecuted — four dairymen convicted, and one physician convicted and fined for not reporting a case of smallpox.

Infectious diseases reported during the year: Smallpox, 210 cases; diphtheria, 462 cases; membranous croup, 39 cases; scarlet fever, 795 cases; typhoid fever, 522 cases; whooping cough, 39 cases; measles, 116 cases.

CIRCLEVILLE, PICKWAY COUNTY.

John L. Cummins, health officer.

Population (estimated), 7,000.

Streets and alleys are in a cleanly condition. There is cause for complaint from lack of sewerage. There are no nuisances which the board has unsuccessfully tried to abate. Night soil is removed in tight barrels and buried outside of city limits.

Contagious diseases are properly reported and a record is kept. The board has enforced restrictive measures in all cases. There are probably 1100 unvaccinated children attending school.

The board has held twelve meetings and spent \$130. No prosecutions were brought.

Infectious diseases reported during the year: Scarlet fever, 12 cases; typhoid fever, 7 cases; whooping cough, 4 cases; other infectious diseases, 15 cases.

CLEVELAND, CUYAHOGA COUNTY.

Dr. Geo. F. Leick, health officer.

Population (estimated), 390,000.

Streets, alleys and yards are in a fairly good condition. There is no cause for complaint on account of lack of sewerage or improper discharge of sewage. There are no nuisances which the board has unsuccessfully tried to

abate. Night soil and garbage is removed by contract for the entire city.

Contagious diseases are properly reported, and a record is kept. We have been able to enforce proper restrictive measures. Smallpox has been more prevalent than usual during the past year.

Total amount spent by this department is \$114,708.16.

Infectious diseases reported during the year: Smallpox, 993 cases; diphtheria, 921 cases; membranous croup, 65 cases; scarlet fever, 876 cases; typhoid fever, 377 cases; whooping cough, 74 cases; measles, 1185 cases; other infectious diseases, 299 cases.

CLYDE, SANDUSKY COUNTY.

F. G. Tuttle, health officer.

Population (estimated), 3000.

Sanitary condition, good. Sewerage, good. Night soil and garbage hauled out of corporate limits.

Contagious diseases are properly reported and a record is kept. Proper restrictive measures are enforced. We have had a few more cases of scarlet fever and measles. Not a person vaccinated during the year that I know of.

Money paid out by board, about \$100.00. No prosecutions.

Infectious diseases reported during the year: Diphtheria, 3 cases; scarlet fever, 27 cases; typhoid fever, 8 cases; measles, 47 cases.

COLLEGE HILL, HAMILTON COUNTY.

J. E. Deininger, health officer.

Population (estimated), 1,400.

Our streets and yards are in very good and clean condition. Our natural drainage is about perfect and we are about to put in a system of sewerage. Are very strict in regard to nuisances in village, and we have none at present. All night soil buried. Garbage burned or buried.

Contagious diseases properly reported and placarded. Keep no record of cases reported. All restrictive measures taken in all cases. Diphtheria was most prevalent last year. About 100 or half the number of school children, vaccinated.

Had about five meetings during the year. Our bills are paid by village treasurer, and we have no record of amount spent. No prosecutions.

We have very little sickness in our village, as it lies very high and natural drainage is good.

Infectious diseases reported during the year: Diphtheria, 6 cases; membranous croup, 2 cases; typhoid fever, 4 cases; measles, 3 cases.

COLLINWOOD, CUYAHOGA COUNTY.

P. E. Kerlin, M. D., health officer.
Population (estimated), 3,680.

The streets and alleys are in a torn up condition, and very bad, due to the construction of a sewer system, and laying of water pipes during the year.

There is just cause for complaint, as we have no sanitary sewer and all sewage must necessarily be thrown on the ground. There are nuisances, such as manure piles, chicken coops, poultry yards, ditches, etc., which the board has unsuccessfully tried to abate. The board and the health officer, assisted by the village solicitor, revised the sanitary code with the intention of abating all nuisances, but have failed because of the proper official refusing to enforce the sanitary law. The night soil is removed four times a year to nearby farms for manure. It is done by contract.

All contagious diseases, excepting chickenpox and measles, have been promptly reported, and a proper record kept. The board has been successful in enforcing restrictive measures.

Typhoid fever and scarlet fever have been somewhat more prevalent than usual. As near as can be estimated

there are about one hundred children unvaccinated in the public schools.

The board has held six regular and six special meetings during the year, and expended \$1305.02.

Infectious diseases reported during the year: Diphtheria, 6 cases; scarlet fever, 14 cases; typhoid fever, 10 cases; measles, 4 cases.

COLUMBIANA, COLUMBIANA COUNTY.

George Roninger, health officer.

Population (estimated), 1,800.

Streets, alleys and yards are in a good condition. No cause for complaint from the lack of sewerage.

There are no nuisances which the board has unsuccessfully tried to abate. The outhouses are cleaned and disinfected twice a year and the night soil hauled away and disposed of.

A record of contagious diseases is kept by the physicians. Board has been able to enforce proper measures. Diphtheria has been the most prevalent contagious disease this winter. No vaccination during the year as known—may have been a few.

Four meetings were held during the year. Fifty dollars is the amount spent by the board during the year. No prosecutions.

Infectious diseases reported during the year: Diphtheria, 57 cases; scarlet fever, 2 cases; typhoid fever, 15 cases.

COLUMBUS, FRANKLIN COUNTY.

W. D. Deuschle, M. D., health officer.

Population (estimated), 140,000.

Alleys and yards in good condition, streets fair. There are complaints from West Side residents about improper discharge of sewage.

The board has been successful in all its attempts to abate nuisances. Night soil is removed between the hours of 10:00 p. m. and 5:00 a. m., by regular vault cleaners who must obtain a permit

for each job. Their work must be approved in each instance by a sanitary officer before they receive their pay.

Garbage is removed in iron carts principally by The Columbus Sanitary Works and Reduction Company, under contract with the city. Some hotel and house garbage is removed by farmers in iron or steel cans upon permits issued to them.

Contagious diseases are, as a rule, properly reported and a complete record of them is kept by the board. The board had been able to enforce proper restrictive measures, except in unreported cases, usually of whooping cough. Measles and scarlet fever have been more than usually prevalent during 1900.

Two prosecutions for adulterating milk with formaldehyde, one for not taking out a milk license, one for selling milk below standard, one for keeping a foul manure pile, and several for keeping unclean vaults. All prosecuted were convicted and fined.

Infectious diseases reported during the year: Smallpox, 26 cases; diphtheria, 205 cases; scarlet fever, 293 cases; typhoid fever, 221 cases; whooping cough, 104 cases; measles, 989 cases; chicken pox, 106 cases.

CONGRESS, WAYNE COUNTY.

Clyde M. Holmes, health officer.

Population (estimated), 200.

Board of health was organized October, 1900. We have met six times to transact business and look after the sick.

Our streets and alleys are in a very good sanitary condition. No complaints have been made in regard to sewerage, in fact, we have very little sewerage in our village. There were no nuisances which were not abated.

Contagious diseases are duly reported by our village physicians. As to being able to enforce proper restrictive measures we have been very successful. Records of diseases are properly kept. Our schools were closed for two weeks

by order of the board on account of scarlet fever.

We know of none who have been vaccinated during the year.

No prosecutions were brought by the board of health during the year.

Infectious diseases reported during the year: Scarlet fever, 9 cases; typhoid fever, 1 case.

CONNEAUT, ASHTABULA COUNTY.

D. S. Cossitt, M. D., health officer.
Population (estimated), 7,500.

The sanitary condition of streets and premises is very good, except at Harbor where sewer system is not completed. Practically all orders of the board of health have been complied with.

Physicians are required to report all contagious and infectious diseases, of which a record is kept. Contagious diseases have been rigidly quarantined; except, whooping cough and measles—measles being simply placarded. An epidemic of smallpox has been successfully stamped out.

Semi-monthly meetings were held from April to November, and, monthly for balance of year. Expenditures, \$1,480.13. No prosecutions.

Infectious diseases reported during the year: Smallpox, 77 cases; diphtheria, 100 cases; membranous croup, 2 cases; scarlet fever, 5 cases; typhoid fever, 44 cases; whooping cough, 8 cases; measles, 72 cases.

CONTINENTAL, PUTNAM COUNTY.

E. S. Drummond, health officer.
Population (estimated), 1,500.

Our board of health has not met for a long time until just lately. They have reorganized now and expect to meet regularly.

COOLVILLE, ATHENS COUNTY.

Dr. A. M. Frame, health officer.
Population (estimated), 325.

Sanitary condition of village is good. Contagious diseases are reported. None vaccinated that I know of.

Our board has regular meetings once a month and called meetings oftener, if necessary. Expenditures, nothing.

The board has had no difficulty with any person—all seem willing to comply with requirements of the board. We have had little to look after or the board would have met with more regularity.

Infectious diseases reported during the year: Scarlet fever, 1 case; whooping cough, 1 case; measles, 42 cases.

CORNING, PERRY COUNTY.

Wm. Anderson, health officer.
Population (estimated), 1,600.

The sanitary condition of the town is fair. The board has abated a number of nuisances. Garbage is removed by wagon.

Contagious diseases are properly reported. Measles and mumps have been more prevalent than usual. There are 150 unvaccinated children attending school.

The expenses of the board amounted to \$68.80. There were no prosecutions.

Infectious diseases reported during the year: Typhoid fever, 3 cases; whooping cough, 100 cases; measles, 26 cases; mumps, 65 cases.

COSHOCTON, COSHOCTON COUNTY.

J. E. Foster, V. S., health officer.
Population (estimated), 6,500.

The present sanitary condition of our village is good. The board of health has maintained an active organization and has been successful in carrying out measures for the restriction of contagious diseases and the abatement of nuisances. Our streets, alleys and yards are in a cleanly condition. There is no cause for complaint from lack of sewerage, or improper discharge of sew-

age. The board has been successful in abating all nuisances ordered abated. Night soil is removed in water-tight tanks, and is deposited in fields and plowed into the earth.

Contagious diseases are properly reported and a record of the same is kept. Whooping cough has been more prevalent than usual. About 70 per cent. of children attending school are unvaccinated. About six persons were vaccinated during the year.

The board of health held only two meetings. They depend upon the health officer to do all the sanitary work, and do not deem it necessary to meet often. Amount expended by board, \$381.40. Three physicians were cited to appear before the mayor and show cause why they did not report chicken pox. They were severely reprimanded by the mayor.

Infectious diseases reported during the year: Diphtheria, 6 cases; scarlet fever, 27 cases; typhoid fever, 12 cases; whooping cough, 119 cases; measles, 12 cases; other infectious diseases, 14 cases.

COVINGTON, MIAMI COUNTY.

H. E. Finfrook, health officer.

Population (estimated), 2,000.

Streets, alleys and yards are kept very clean. Have no sewer system. All nuisances are abated as soon as ordered. Night soil is hauled in air-tight barrels to farms and plowed under.

All contagious diseases are properly reported and a record kept of same. The orders of the board have been obeyed. The most prevalent contagious disease has been scarlet fever.

The board of health held eight meetings in 1900. The total amount spent by the board was \$69.43. There was one prosecution for selling unwholesome meat.

Infectious diseases reported during the year: Diphtheria, 2 cases; membranous croup, 3 cases; scarlet fever, 19 cases; typhoid fever, 1 case; measles, 5 cases.

CRESTLINE, CRAWFORD COUNTY.

A. J. Cover, health officer.

Population (estimated), 3,285.

Board of health has not maintained an active organization for some years past. We have been wholly dependent upon reports of physicians and others, as well as our own observations, in enforcing proper measures for the prevention of contagious diseases and the abatement of nuisances when reported to the mayor or myself.

Streets, alleys and yards are in very good condition as to cleanliness. Sewerage is good. Night soil is usually removed and buried outside the corporate limits at sufficient distance from dwellings.

Contagious diseases are in general properly reported. No complete record is or has been kept for some time past. Measles and typhoid fever most prevalent.

Amount spent by board of health \$50, salary of health officer.

Infectious diseases reported during the year: Scarlet fever, 11 cases; typhoid fever, 5 cases; measles, 209 cases; other infectious diseases, 3 cases.

CRESTON, WAYNE COUNTY.

Philip Baum, health officer.

Population (estimated), 850.

Streets and alleys are fairly clean but could be better. There is cause for complaint from lack of sewerage. The sewerage nuisance is the only one not coped with successfully. We have a night soil and garbage man employed, whose duty it is to remove same outside of corporation.

Contagious diseases are properly reported and a record kept. Board enforces restrictive measures. Typhoid fever and chicken pox were the most prevalent diseases. Twenty-two unvaccinated children attend our schools.

Board of health held 12 meetings during the year. The regular meetings of board are the first and third Tuesdays

of each month, but it is difficult to get some members to attend, so much so, that a quorum is lacking and no business done. It looks as though some men fear that they may tread on someone's toes if certain cases are touched. Thirty-five dollars spent for salaries, \$10 for books, etc. No prosecutions by board.

Infectious diseases reported during the year: Typhoid fever, 4 cases; chicken pox, general but mild.

CROOKSVILLE, PERRY COUNTY.

Fred Young, health officer.

Population (estimated), 800.

Streets and alleys are in good condition. Night soil and garbage hauled out of corporation.

No contagious diseases occurred in the village during the year. A record of such would be kept.

The board of health held monthly meetings. Amount spent, \$75.00.

CUMBERLAND, GUERNSEY COUNTY.

George E. McEndree, health officer.

Population (estimated), 600.

The sanitary condition of our town is as good as could be expected of a town without a sewerage system.

All cases of contagious diseases are properly reported, but no record is kept. No vaccinations.

Have held two meetings during year. No expenses.

We have had an exceptionally healthy season.

Infectious diseases reported during the year: Typhoid fever, 1 case.

CUYAHOGA FALLS, SUMMIT COUNTY.

I. N. Reid, health officer.

Population (estimated), 3,500.

The streets, alleys and yards are in a cleanly condition. There is some com-

plaint from lack of sewerage. We are now putting in waterworks and I am in hopes it will bring sewerage. There are no nuisances which the board has unsuccessfully tried to abate. We have a man employed to haul away night soil.

Contagious diseases are properly reported and a record kept. The board has enforced restrictive measures. Scarlet fever has been more prevalent than usual. I am unable to give the number of persons vaccinated during the year. There are 446 unvaccinated children attending school.

Four meetings were held and \$2,500 was expended.

DALTON, WAYNE COUNTY.

A. H. Arick, health officer.

Population (estimated), 750.

Our streets and alleys are in good shape. All orders for the abatement of nuisances have been complied with. There is no arrangement to take care of night soil.

Contagious diseases are in general reported according to law. There is no record kept of such diseases. I asked the council to get a record book but they have neglected it. As to persons vaccinated, I know of none. The most prevalent disease was typhoid fever.

The health board held six regular meetings and two special meetings.

We have about 175 pupils, 70 have been vaccinated and the balance have not been. The amount of money spent by the health board was \$10.00.

Infectious diseases reported during the year: Diphtheria, 3 cases; typhoid fever, 6 cases; whooping cough, 33 cases.

DANVILLE, KNOX COUNTY.

Dr. C. R. Bradfield, health officer.

Population (estimated), 500.

The sanitary condition of streets, alleys and yards is good. We have no sewerage system. There are no nuisances which have not been abated. We have

no system of removing night soil or garbage.

Contagious diseases are properly reported. I don't think there has ever been any regular record kept. The board has had no trouble in enforcing restrictive measures. Have had no epidemic of any kind. No one has been vaccinated during the past year to my knowledge. There are very few children attending school who have not been vaccinated.

The board has not had a regular meeting in the past year. No money has been spent by the board, nor any prosecutions brought.

Infectious diseases reported during the year: Scarlet fever, 6 cases; typhoid fever, 2 cases; whooping cough, 2 cases; measles, 1 case.

DAYTON, MONTGOMERY COUNTY.

C. W. King, M. D., health officer.

Population (estimated), 85,333.

I have the honor to report our city in an excellent sanitary condition. Our board has met with excellent success in abating nuisances. Our city maintains a crematory, and the collection and disposing of the garbage has been done the past year under the immediate direction of our board of city affairs. The cleaning of vaults is under the direction of the board of health. Some of the night soil is disposed of at crematory, but as they are not able to handle it all, some has been hauled into the country and buried in trenches.

We believe our physicians report promptly all contagious diseases and a record of same is kept at this office. We have had no trouble in enforcing proper restrictive measures. Owing to some misunderstanding on the part of some of our physicians in regard to the law, cases of typhoid fever were not all reported until late in the year, when their attention was called to the law by our health officer, since which time we believe all cases are reported. The most

prevailing contagious diseases have been scarlet fever and diphtheria. Number of unvaccinated children attending our public schools as given by the superintendent is 1607; number attending the parochial schools, about 700.

Our board has held during the year 16 meetings. Amount expended by our board for the year ending December 31, 1900, as follows: For regular sanitary work, \$5,099.79; for special sanitary work owing to the prevalence of smallpox in our community, \$1,793.24. Total expenditures, \$6,893.03. Number of prosecutions begun during the year, 18; two of which are still pending, all others having complied with orders as soon as notified of the beginning of action against them.

Infectious diseases reported during the year: Smallpox, 9 cases; diphtheria, 163 cases; membranous croup, 15 cases; scarlet fever, 220 cases; typhoid fever, 67 cases; measles, 8 cases; other infectious diseases 6 cases.

DEFIANCE, DEFIANCE COUNTY.

Dr. E. E. K. Chapman, health officer.

Population (estimated), 9,000.

We think there has been quite an improvement in the sanitary condition of the city since our last report. Our board has taken an active interest in sanitary work and not only maintain a thorough organization, but we have been exceedingly successful in combatting and disposing of all questions arising. We work in harmony, for the best interests of our city, and I can truly say we have the community in accord with our work.

Our physicians are very prompt in reporting all cases of contagious diseases and a record of the cases is filed by the board of health. We have about 850 unvaccinated children attending our public schools.

We have held 20 meetings and the board has expended \$1,731.79.

DEGRAFF, LOGAN COUNTY.

J. W. Henderschott, health officer.

Population (estimated), 1,200.

Our streets and alleys are kept in a cleanly condition and we are proud of our town's sanitary condition.

Contagious diseases are promptly reported if any occur. The board has abated all nuisances reported. There has been no vaccination in our town.

The board of health has had twelve meetings in the last year.

DELAWARE, DELAWARE COUNTY.

Dr. J. K. James, health officer.

Population (estimated), 8,000.

Alleys, streets and yards are in a cleanly condition. Sewage question now pending. Nuisances have been successfully abated.

Contagious diseases are properly reported and a record kept. We have been able to enforce restricting measures. Measles and scarlet fever have been more prevalent than usual. There are about 200 unvaccinated children attending school.

The board of health met every month. There were three prosecutions for not cleaning vaults. Amount spent, \$275.00.

Infectious diseases reported during the year: Smallpox, 10 cases; diphtheria, 14 cases; membranous croup, 1 case; scarlet fever, 16 cases; typhoid fever, 62 cases; measles, 73 cases.

DELPHOS, ALLEN AND VAN WERT COUNTIES.

Dr. N. E. Brundage, health officer.

Population (estimated), 4,517.

We have no sanitary sewerage and there is cause for complaint on account of this. Garbage and night soil is taken out of town and buried. Yards, streets and alleys are in a good clean condition and kept in that way.

Contagious diseases are properly reported and there is a record kept.

The board has been able to enforce all necessary measures. Scarlet fever has been the most prevalent disease. There have been but few vaccinations, perhaps six. Superintendent of schools does not know the number of vaccinated children.

There have been seven meetings of the board during the year 1900. The following amounts were spent for the purpose named:

Material used for fumigating,	
about	\$10 00
Flushing Flat Fork creek, about..	10 00
Sanitary Police Salary, about...	125 00
Health Officer's Salary, about..	200 00
Printing	15 00
Total	\$360 00

This report is from June 1, 1900, until Dec. 31, 1900—this being the time of my serving as health officer. Prior to that there was no record.

Infectious diseases reported during the year: Membranous croup, 1 case; scarlet fever, 15 cases.

DELTA, FULTON COUNTY.

Dr. William Ramsey, health officer.

Population (estimated), 1,230.

You must not infer from the number of deaths that our town is not in a good sanitary condition. A large portion of those deaths are old people moved into town from farms and elsewhere. Only two children died in the year.

We did not have any contagious diseases of any kind. Our sanitary condition in every respect is good. No sickness excepting la grippe.

DENNISON, TUSCARAWAS COUNTY.

Dr. L. H. Hughes, health officer.

Population (estimated), 3,763.

Infectious diseases reported during the year: Smallpox, 3 cases; diphtheria, 10 cases; membranous croup, 5 cases; scarlet fever, 18 cases.

DESHLER, HENRY COUNTY.

James E. Robinson, health officer.

Population (estimated), 1,800.

Streets, alleys and yards are not in a cleanly condition. There is cause for complaint on account of lack of sewerage, and because of the improper discharge of a sewer into an open ditch within the corporate limits.

Contagious diseases are reported, but a complete record is not kept. Restrictive measures have been enforced. Diphtheria has been more prevalent than usual. There were about 222 persons vaccinated during the year. About 420 children attend school who have not been vaccinated.

The board of health held five meetings during the year and expended \$416.00. No prosecutions.

Infectious diseases reported during the year: Diphtheria, 35 cases; scarlet fever, 4 cases; typhoid fever, 8 cases; whooping cough, 72 cases; measles, 16 cases.

DOYLESTOWN, WAYNE COUNTY.

R. Martin, health officer.

Population (estimated), 1,100.

Sanitary condition of village very good. No arrangement for disposal of night soil or garbage. Has been no complaint to health board.

Contagious diseases have been promptly reported and record kept. Houses have been properly fumigated and no further trouble expected. Total enrollment of schools, 294; vaccinated, 133; not vaccinated, 161.

Infectious diseases reported during the year: Diphtheria, 8 cases.

DRESDEN, MUSKINGUM COUNTY.

C. W. Carter, health officer.

Population (estimated), 1,800.

Streets, alleys and yards are in fair condition. Board was able to abate all

nuisances except hogs, which some owners refused to remove. A low place north of town is used in which to deposit garbage.

Contagious diseases are seldom reported. There is no record of same. Board has not been able to enforce proper restrictions. No vaccinations in past year.

Board held nine regular meetings. No prosecutions. About \$25 was expended, exclusive of salary paid health officer and secretary. Salary of health officer, \$60.00.

DUPONT, PUTNAM COUNTY.

T R. Hart, health officer.

Population (estimated), 500.

The streets, alleys and yards are in fairly good sanitary condition for this season of the year. On the approach of the sickly season, however, additional precautions should be taken. No cause for complaint from lack of sewerage or from an improper discharge of sewage is known to exist. There are no nuisances which the board has unsuccessfully tried to abate. There are no arrangements for the removal and disposal of night soil and garbage.

So far as scarlet fever is concerned, all cases were reported to the board. There were some mild cases of mumps, and, on the outskirts of the village, two or three cases of typhoid malaria that were successfully controlled without the action of the board. A record of all diseases reported is kept. The board has been able to enforce proper restrictive measures. Scarlet fever and mumps have been more prevalent than usual. Estimated number of persons vaccinated, 25. The statistics of the public schools are as follows: High school enrollment, 30; number unvaccinated, 24. Grammar school enrollment, 46; number unvaccinated, 5. Primary department enrollment, 40; number unvaccinated, 23. Total enrollment, 116; total number unvaccinated, 52.

The board has had fifteen meetings during the year ending December 31,

1900. The board expended \$109.63 during said year. There were no prosecutions brought for violations of orders or health laws. The present membership of the board is as follows: C. A. Tracy, president; A. S. Medley, B. D. Hubbell, Henry Beck, George Etter, William Etter, D. B. McKinley, M. D., J. C. Shank, clerk of board; T. R. Hart, health officer.

Infectious diseases reported during the year: Scarlet fever, 8 cases.

EAST CLEVELAND VILLAGE, CUYAHOGA COUNTY.

J. H. Stamberger, health officer.

Population (estimated), 3,000.

I hereby submit the annual report for the year 1900 for the village of East Cleveland. During the latter part of 1899 we commenced the operation of a complete sewer system for the village of East Cleveland. We have what is known as the Waring System and it is very satisfactory. The tests of the effluent show an average for the year of 96 per cent. This is better than the contract which the Waring people call for. There was a clause in the contract that called for a purification of 90 per cent. Thus you see the plant has done more than we anticipated, making the water and sewage that goes through the process purer than when first taken from the lake. The population of East Cleveland is increasing so fast that our present plant is being pushed to its greatest capacity and we have got to duplicate the plant at once. A special election has been called for March 4 to vote on the question of selling \$20,000 worth of bonds to duplicate our present plant. Some people here have been prejudiced against the system from the very start, but I must say that there never was to my mind a more perfect operation for the purification of sewage than the one we have installed here. Before we had a sewer system in East Cleveland we were in a sad plight. Drains and ditches and creeks were used to empty sewage into, and almost any place you

went you could see the bad effects of it. The board of health and the health officer went to work to clean up the town and today we have as clean a village as you can find in the state of Ohio. The plumbing of houses had been done in a careless manner, and to relieve that situation the health officer was appointed plumbing inspector. As the result we are getting today the best work at East Cleveland that the plumbing fraternity can produce. Taken all in all we are progressing rapidly in sanitary matters, and feel that we have the most healthy and clean village in the state of Ohio.

Infectious diseases reported during the year: Smallpox, 3 cases; diphtheria, 9 cases; scarlet fever, 2 cases; typhoid fever, 1 case; measles, 4 cases.

EAST LIVERPOOL, COLUMBI- ANA COUNTY.

C. B. Ogden, M. D., health officer.

Population (estimated), 16,486

Streets alleys and yards are kept in a cleanly condition. The city has fourteen miles of streets, paved with fire brick, and from time to time they are washed by using hose. A street sweeper and sprinkler are also used. There are thirteen miles of main sewer and a sanitary sewer is now being constructed in District No. 2. There is some cause for complaint as this district is badly in need of a sewer system, and despite the efforts of the board of health, the work has not been pushed with the proper vigor.

The board has abated all nuisances, and night soil is removed in an air tight wagon to a garbage furnace where it is burned.

Contagious diseases are properly reported. A careful record is kept and the proper restrictive measures enforced. Diphtheria, scarlet fever, measles and typhoid fever have been the most prevalent during the year. No record has been kept of the persons vaccinated during the year, and it is impossible to give number of children attending school that have been vaccinated.

The board held nine meetings during the year, and the expenses amounted in the neighborhood of \$1,500.

Infectious diseases reported during the year: Diphtheria, 34 cases; membranous croup, 1 case; scarlet fever, 33 cases; typhoid fever, 89 cases; measles, 33 cases.

EAST PALESTINE, COLUMBIANA COUNTY.

Levi Neville, health officer.

Population (estimated) 3,000.

Our board of health was organized June 11, 1900. Since that time we have held eight meetings. Have had our streets, alleys and yards cleaned and put in a sanitary condition. We have had no complaints in regard to sewerage or nuisances. Have been successful in having everything done without any trouble.

We have a good arrangement for removing night soil. Have air tight barrels in which it is taken to the country, mixed with barn yard manure and spread on vacant land. Our garbage is burned.

Contagious diseases are not reported. The board has not enforced restrictive measures. The doctors or undertakers do not make any reports to the board. The health officer desiring any information in regard to deaths and sicknesses, has to ask the doctors and undertakers and does not get full reports.

The total expenses of the board during the seven months it was organized were \$8.50.

Infectious diseases reported during the year: Diphtheria 8 cases; whooping cough 3 cases.

ELGIN, VAN WERT COUNTY.

L. P. Jackson, health officer.

Population (estimated), 250.

Streets and alleys in good condition. No complaint from lack of sewerage. Nuisances are all abated. The soil

from vaults must be taken from village or buried three feet deep and not near any water supply.

The contagious diseases, I think, were not properly reported. A record of contagious diseases is kept. Scarlet fever most prevalent. No persons vaccinated.

Board has had three meetings and caused cleaning of privy vaults and removal of garbage and manure. No precautions made.

ELIDA, ALLEN COUNTY.

S. A. Hitchcock, M. D., health officer.

Population (estimated), 500.

The streets, alleys and yards are in a cleanly condition. There is no cause for complaint from the lack of sewerage at the present time.

Contagious diseases are promptly reported. I don't think there is a record of such diseases kept. The board has enforced proper restrictive measures. Scarlet fever has been the most prevalent contagious disease. There has been no vaccinations during the year to my knowledge. Number of unvaccinated children attending public school, 124.

The board of health has had eight meetings. I am not able to give the amount spent by board during the year. We had no prosecutions for violation of orders.

During the past year we have had very little sickness in the village and I believe it is all due to good sanitary conditions.

Infectious diseases reported during the year: Scarlet fever, 6 cases.

ELMWOOD PLACE, HAMILTON COUNTY.

Dr. E. T. Busching, health officer.

Population (estimated), 2,600.

Streets and yards in good condition. There is a lack of sewerage. Same unabatable nuisances exist as reported in last year's annual report. Night soil hauled across Mill creek and buried.

Garbage and ashes dumped on Wunker's farm across Mill creek.

Contagious diseases properly reported and record kept. Restrictive measures fairly good. Contagious diseases most prevalent are diphtheria, membranous croup and phthisis.

Board of health has held twelve meetings during the year. Board has spent \$87.88 during year 1900. No prosecutions.

Infectious diseases reported during the year: Diphtheria, 8 cases; membranous croup, 4 cases, typhoid fever, 1 case.

ELYRIA, LORAIN COUNTY.

Dr. Wm. E. Hart, health officer.

Population (estimated), 9,000.

During the past year our board has succeeded in interesting our city council in making extended improvements regarding the discharge of sewage, and at the present time are laboring with the council for still greater improvements that are almost imperative.

Our scavenger has just purchased a farm on which he expects to deposit all night soil and swill.

We have had quite an epidemic of scarlet fever during the past year.

We kept no record of our contagious diseases. Our sanitary policeman, however, keeps for himself a record of houses quarantined.

We have had no deaths from any contagious disease, excepting diphtheria.

The township trustees furnished us with fifty dollars worth of antitoxin, which no doubt very materially aided us in stamping out an epidemic of diphtheria.

We have had no new cases of small-pox since last spring, due, I think, largely to the fact that last winter our people in Elyria were almost universally vaccinated.

We could do better work if we had the full moral support of all the medical fraternity.

Our doctors, as a rule, are too easy with their patients, too anxious to lift quarantine, etc.

The sanitary condition of our town is as good as the best.

Infectious diseases reported during the year: Smallpox, 29 cases; diphtheria, 19 cases; scarlet fever, 116 cases; typhoid fever, estimated, 30 cases; measles, 4 cases; chickenpox, 6 cases.

ENON, CLARKE COUNTY.

J. P. Pierce, health officer.

Population (estimated), 350.

Our board of health has had no meeting during the year and fortunately we have had no contagious diseases in our village.

Streets and alleys are reasonably clean, having been cleaned up in the spring. About one-half of the children attending our schools have not been vaccinated.

I will just say that there is a tendency to ignore anything in the shape of a board of health in this village, and I think that such will be the case until some fatal epidemic takes hold of us. Then perhaps we will awaken to our duties. I think that the keeping up of a board of health should be made compulsory and then perhaps there might be something done. We have the usual number of hog pens contained in a village of this size and during the summer months they get pretty loud, but it is taken for granted that it is all right and we must put up with them.

There is no arrangement made for the disposal of night soil.

FAIRPORT, LAKE COUNTY.

A. J. McCue, health officer.

Population (estimated), 2,300.

Streets, alleys and yards are not in a cleanly condition. There is some cause for complaint on account of lack of sewerage. The board has been successful in the abatement of nuisances. Night soil is removed at night in barrels.

Contagious diseases have been properly reported and a record is kept. The

board has been able to enforce restrictive measures. There were about 200 persons vaccinated during the year.

The board held twelve meetings.

Infectious diseases reported during the year: Smallpox, 1 case; diphtheria, 2 cases.

FAYETTE, FULTON COUNTY.

Horace Ford, health officer.

Population (estimated), 800.

Streets are clean. The people are unusually healthy.

Infectious diseases reported during the year: Typhoid fever, 1 case; other infectious diseases, 5 cases.

FELICITY, CLERMONT COUNTY.

C. J. Young, health officer.

Population (estimated), 800.

Our board has maintained its organization, but has not been very active. Enough, however, to prevent the spread of contagious diseases. Our village has been in good sanitary condition during the past year. All garbage, night soil, etc., is either burned or buried. I have heard no complaint of our sewerage.

Our doctors have so far, reported promptly all cases of contagious diseases. Scarlet fever has been more prevalent than usual, having had cases here for several years. I have not found anyone who has been vaccinated during 1900. There are 53 in our schools who have never been vaccinated, out of an enrollment of 120. The board of health has held three regular meetings and two special meetings during the year. Our expenses have been \$42.00.

Infectious diseases reported during the year: Diphtheria, 1 case; scarlet fever, 5 cases; measles, 1 case.

FINDLAY, HANCOCK COUNTY.

Amos Beardsley, health officer.

Population (estimated), 17,613.

Streets, alleys and yards are in good sanitary condition. There is cause for complaint from lack of sewerage, and for want of proper place to discharge same. The board has successfully abated all nuisances that were brought before them. Night soil is removed outside city limits and plowed under. Garbage is gathered and taken to a dump-grounds, and there taken care of by being covered with air-slaked lime.

Contagious diseases are properly reported, a record is kept. Proper restrictions have been enforced. Diphtheria has been very much more prevalent than usual. About 1000 have been vaccinated. About 400 unvaccinated children attend school.

The board held thirty meetings last year. The total amount expended during the year was \$2,307.07, including the care of two cases of smallpox. We had no prosecutions.

Infectious diseases reported during the year: Smallpox, 2 cases; diphtheria, 144 cases; membranous croup, 10 cases; scarlet fever, 50 cases; typhoid fever, 38 cases; whooping cough, 13 cases; measles, 40 cases; other infectious diseases: chickenpox, 44 cases.

FOREST, HARDIN COUNTY.

S. L. Bushong, health officer.

Population (estimated), 1,300.

We have a regularly organized board of health in the village of Forest, and said board has been fairly successful in enforcing proper measures for the prevention of contagious diseases, and the abatement of nuisances. Streets, alleys, and yards, are kept in a fairly good sanitary condition. We have no regular system of sewerage. There have been no nuisances which the board has not been able to abate. Night soil is removed from village and buried.

Contagious diseases are fairly well reported. Board keeps a record of all diseases reported. Scarlet fever has been the most prevalent contagious disease the past year. Have no means of

knowing the exact number of persons vaccinated.

The board has held four regular meetings during the year, and two called meetings. The amount of money expended by board is in the neighborhood of \$150.00. There has been no prosecutions brought by board for violation of any of the orders.

Infectious diseases reported during the year: Scarlet fever, 10 cases.

FORT JENNINGS, PUTNAM COUNTY.

Dr. J. F. George, health officer.

Population (estimated), 325.

Infectious diseases reported during the year: Typhoid fever, 10 cases; measles, 5 cases.

FOSTORIA, SENECA COUNTY.

W. N. Caldwell, health officer.

Population (estimated), 8000.

Sanitary condition of city is good. Street, alleys, and yards are fairly clean. There has not been any complaint as regards sewage. No nuisance on record. Night soil taken care of by private individuals. Garbage hauled by city.

All contagious diseases are properly and promptly reported, and a record of same kept. The board has been able to enforce restrictive measures. Notice nothing unusual as to different contagious diseases. Unable to give you any idea of number of vaccinations. Unable to find any unvaccinated children.

The board of health held seven meetings in 1900. Expenditure about \$1200. No violations prosecuted.

Infectious diseases reported during the year: Diphtheria, 5 cases; scarlet fever, 9 cases; typhoid fever, 20 cases; whooping cough, 20 cases; measles, 3 cases.

FRANKLIN, WARREN COUNTY.

Dr. D. A. Williams, health officer.

Population (estimated), 3,000.

The sanitary condition of our town is pretty fair.

We have a little trouble about getting members of our poorer families to take as much care as should be taken in cases of scarlet fever.

We had eleven meetings, regular, and four or five called meetings last year. As to amount expended, I cannot tell exactly, but it was near \$300.00.

We have been trying to get two prominent families to run their private sewers to Miami river but they are inclined to think we are imposing on them. We are going to keep at them until this is done.

Infectious diseases reported during the year: Diphtheria, 5 cases; membranous croup, 1 case; scarlet fever, 25 cases.

FRAZEYSBURG, MUSKINGUM COUNTY.

Wm. Host, health officer.

Population (estimated), 750.

Expenses for the year 1900 were \$8.70.

Infectious diseases reported during the year: Diphtheria, 1 case; scarlet fever, 9 cases; typhoid fever, 2 cases.

FREDERICKSBURG, WAYNE COUNTY.

D. P. Shie, M. D., health officer.

Population (estimated), 900.

Sanitary conditions of the village, good.

All contagious diseases are properly and promptly reported of which a record is kept by health officer. Diphtheria has been more prevalent than usual, but at this date we have no one ill of contagious diseases.

Have had three meetings of the board of health during the year. The board has had no expenses.

Infectious diseases reported during the year: Diphtheria, 8 cases; membranous croup, 3 cases; scarlet fever, 1 case; typhoid fever, 3 cases.

FREEPORT, HARRISON COUNTY.

W. H. Lewis, health officer.

Population (estimated), 800.

The present sanitary condition of our village is good. The board maintains an active organization. Our streets and alleys are clean. We have no regular system of sewerage. Night soil is properly disinfected and buried.

All infectious diseases are quarantined, and premises are fumigated. We have had no prosecutions for not obeying orders of board.

Our board has regular meetings once a month. Expenses amounted to \$50.00 during the year for sanitary police and fumigating houses. Board has adopted a resolution recommending council to pass an ordinance prohibiting keeping of hogs inside corporation.

Infectious diseases reported during the year: Typhoid fever, 3 cases; whooping cough, 10 cases; measles, 23 cases.

GAHANNA, FRANKLIN COUNTY.

S. Cashner, mayor.

Population (estimated), 234.

Our village is in splendid condition. I see that filth and nuisances are properly removed.

The expenses have only been \$3 during the last year.

GALION, CRAWFORD COUNTY.

H. H. Hartman, M. D., health officer.

Population (estimated) 7,292.

The streets, alleys and yards are kept in cleanly condition. A great deal of complaint from lack of sewerage; also complaint in regard to the discharge of sewage into the Pickle run and Whetstone creek. We should have sewers

by all means. Night soil is taken out of the city by private contractors and buried in trenches.

Contagious diseases are promptly reported and a record kept. Measles has been more prevalent than any other disease. Restrictive measures have been enforced.

The board held fourteen meetings during the year 1900. Total amount spent \$575.06. One violation of quarantine laws in a case of scarlet fever. Convicted and fined \$10.00 and costs.

Infectious diseases reported during the year: Diphtheria, 3 cases; scarlet fever, 29 cases; typhoid fever 37 cases; measles, 446 cases; other infectious diseases, 2 cases.

GALLIPOLIS, GALLIA COUNTY.

Dr. James Johnston, health officer.

Population (estimated), 6,000.

The sanitary condition of the city is good. The board of health is active to prevent spread of contagious diseases. Streets, yards and alleys are in a cleanly condition and drainage good. There are no nuisances in the city.

Contagious diseases are properly reported at present but have not been heretofore. Record of such diseases is kept when reported. Smallpox has been more prevalent than usual. There were probably three hundred vaccinations during the year. There are no unvaccinated children attending schools at present and there has not been since the outbreak of smallpox. I issued an order to all teachers to exclude all that have not been vaccinated but the exact number I cannot tell. The majority excluded have since been vaccinated and returned to school.

The board of health met every two weeks up to July, since that, had no meetings until in the last two months since which time have been meeting every week. There had been no money spent by board of health up to our present trouble, and it is impossible to make an estimate until our trouble is over. There have been no prosecutions brought.

Infectious diseases reported during the year: Smallpox, 28 cases; diphtheria, 3 cases; membranous croup, 2 cases; scarlet fever, 4 cases; whooping cough, 20 cases.

GENEVA, ASHTABULA COUNTY.

F. C. Smith, M. D., health officer.

Population (estimated), 2,300.

Our streets and alleys are in a fairly clean condition. There is great complaint from lack of sewerage. There is no place to drain anything. Next spring we are to put in waterworks, which may help matters. We have abated all nuisances reported. Night soil and garbage is taken outside of the village limits.

Contagious diseases are properly reported, a record is kept of such cases and the board has had no trouble in enforcing proper restrictive measures. Whooping cough and measles have been the most prevalent diseases during the year. About 50 per cent. of school children are not vaccinated. There were few persons vaccinated during the year.

Board meetings held during year, 9. Money expended during year, \$179.67.

Infectious diseases reported during the year: Diphtheria, 8 cases; membranous croup, 1 case, scarlet fever, 2 cases; typhoid fever, 5 cases; whooping cough, 50 cases; measles, 32 cases.

GERMANTOWN, MONTGOMERY COUNTY.

William Schaeffer, health officer.

Population (estimated), 2,000.

Streets, alleys and yards are in a sanitary condition. There is no complaint on account of sewerage. The board has been successful in the abatement of nuisances. Night soil is removed in a closed tank at night outside the limits of corporation.

Contagious diseases are properly reported and a record kept. The board has enforced restrictive measures in such cases. Scarlet fever has been the

most prevalent contagious disease. About fifteen persons were vaccinated during the year. There are 160 unvaccinated children attending school.

Eleven meetings were held and \$350 expended. There were no prosecutions.

Infectious diseases reported during the year: Smallpox, 2 cases; scarlet fever, 11 cases; typhoid fever, 2 cases.

GIRARD, TRUMBULL COUNTY.

Dr. D. R. Williams, health officer.

Population (estimated), 3,000.

Sanitary condition is fairly good. Natural drainage is very favorable. We have no sewerage except private drains and surface drainage. In the near future this will be inadequate to properly dispose of the increasing sewage accommodations which will result from the increasing population, and the question of water supply and sewerage will soon confront the citizens of our village for solution. Our board has been successful in abating nuisances. For the removal of night soil a scavenger is elected by the board for one year, and he is under \$100 bond to perform the work according to requirements. For the disposition of garbage no provision is made. The matter of procuring a dumping ground is now under consideration by the village council.

Contagious diseases are reported and a record kept of same, and as a rule quarantine restrictions are well enforced. The most prevalent contagious diseases have been measles and whooping cough.

The board has held 16 meetings and have expended \$250.80. One prosecution was brought for interfering with a sanitary policeman for putting up a measles card. The person was arrested and fined.

Our board has maintained an active organization and has been fairly successful in enforcing its order and regulations.

Infectious diseases reported during the year: Diphtheria, 4 cases; scarlet fever, 1 case; typhoid fever, 1 case;

whooping cough, 18 cases; measles, 51 cases.

GLENDAL, HAMILTON COUNTY.

Clifford Allen, health officer.

Population (estimated), 1,475.

Streets, lanes and yards are in good condition. Sewerage good. Night soil and garbage is removed and deposited outside of village.

Contagious diseases are promptly reported and record kept of them. All rules of the board promptly enforced. No unvaccinated children are allowed to attend school.

Board meets once a month. Amount spent, \$125.00.

Infectious diseases reported during the year: Scarlet fever, 9 cases; measles, 3 cases.

GRAFTON, LORAIN COUNTY.

C. N. Storrs, health officer.

Population (estimated), 1,200.

Infectious diseases reported during the year: Scarlet fever, 16 cases; whooping cough, 10 cases.

GRAND RIVER, LAKE COUNTY.

H. J. Vallean, health officer.

Population (estimated), 400.

The present sanitary condition of this village is good. There is no system of sewerage, but garbage and other unsanitary matter is successfully disposed of. The population is scattered over a large area.

Contagious diseases are not formally reported, but the health officer takes note of those that occur.

The board of health is fully organized, and has met six times during the year just closed. Records pertaining to this office have not been regularly kept. The board expended about \$150.00 during the year.

Children of the public schools have not, for the most part, been vaccinated.

Infectious diseases reported during the year: Typhoid fever, 1 case.

GREEN CAMP, MARION COUNTY.

George W. Collins, health officer.

Population (estimated), 400.

Sanitary condition of village good. We have an active organization now. Streets and alleys are in good shape. The sewerage of village is satisfactory.

Have had no cases of contagious diseases in our village in the last year except measles and they were well taken care of, not a single death resulting.

The board held three meetings.

Infectious diseases reported during the year: Measles, 50 cases.

GRENSPRING, SENECA COUNTY.

Dr. H. L. S. Hinkley, health officer.

Population (estimated), 1,200.

The present sanitary condition of the town is good. Sewerage is fairly good. We have had no trouble in abating nuisances.

Contagious diseases are all reported and record kept of same. None have been vaccinated during the year and very few of the smaller children have ever been vaccinated.

Few meetings have been held but the board is active. Expenses about \$40.00.

Infectious diseases reported during the year: Typhoid fever, 2 cases; whooping cough, 5 cases.

GROVE CITY, FRANKLIN COUNTY.

Theodore Jahn, health officer.

Population (estimated), 1,000.

The streets and alleys are in fair condition. There is no cause for any complaint from lack of sewerage. At present there is no arrangement for removal of night soil.

Contagious diseases are promptly reported and recorded, and it seems that measles is the most prevalent. The doctors never reported to me the number vaccinated in 1901.

Total amount spent, \$36.00. No prosecutions.

Infectious diseases reported during the year: Diphtheria, 4 cases; membranous croup, 1 case; scarlet fever, 1 case; typhoid fever, 2 cases; whooping cough, 35 cases; measles, 45 cases; other infectious diseases, 18 cases.

HAMILTON, BUTLER COUNTY.

A. L. Smedley, M. D., health officer.
Population, 23,914.

We have no regular board of health in this city. Under a special law the board of control is the legislative board and also performs the duties of the board of health. This board has done unusually well in regard to health measures. There has not been a single case in which they have not given me the heartiest and promptest support in every respect. We have been very fortunate in preventing contagious diseases until scarlet fever broke out about two months ago; and it still continues in spite of the most radical methods we can use to prevent it. We have this year been able to abate all nuisances as they arose without having to resort to law in a single case. Our streets and alleys are in a miserable condition, they not having had a thorough cleaning in a year. This, as I understand it, is chiefly due to a lack of money in the street fund.

The sewerage seems to have been fairly satisfactory and is being greatly improved, on account of the large number of streets being prepared to be paved.

The garbage question has been a great source of complaint; the garbage being dumped on vacant lots in the city, and laying sometimes for a month at a time before being covered with earth. However, a solution of this question seems to be in sight; the matter having been submitted to a vote of the people, and a bond issue for \$12,000.00 having been carried to erect a crematory.

In regard to contagious diseases, it was necessary, owing to the carelessness

of a few physicians, to issue a public notice calling their attention to the laws governing the reporting of contagious diseases. After these notices were served, we had no further trouble. A complete record of all contagious diseases is kept.

At your request, in regard to vaccinated and unvaccinated children attending the public schools, Mr. S. L. Rose, superintendent of public schools, has kindly furnished me the following: There are about 300 first year pupils and about 75 pupils above the first grade who have not been vaccinated. There are probably 20 pupils in the entire schools who have been vaccinated within the past year. The total enrollment in the schools is 3,500.

Infectious diseases reported during the year: Smallpox, 1 case; Diphtheria, 15 cases; membranous croup, 2 cases; scarlet fever, 112 cases; typhoid fever, 11 cases; measles, 2 cases; phthisis pulmonalis, 2 cases.

HANGING ROCK, LAWRENCE COUNTY.

Joseph Kinkaid, health officer.
Population (estimated), 500.
Our sanitary condition is good.

Sixty-three persons were vaccinated this year. There are 23 unvaccinated children attending school.

The board has spent \$96.00.

Infectious diseases reported during the year: Smallpox, 7 cases; membranous croup, 2 cases; typhoid fever, 8 cases; whooping cough, 19 cases; measles, 41 cases.

HARROD, ALLEN COUNTY.

John Blair, Sr., health officer.
Population (estimated), 400.

The board of health meets once a month and it looks after sanitary matters closely. The board spent \$28.00 during the year.

Infectious diseases reported during the year: typhoid fever, 6 cases; measles, 1 case.

HARTWELL, HAMILTON COUNTY.

O. W. Butler, M. D., health officer.

Population (estimated) 2,000.

Streets and alleys are cleanly and there is no cause for complaint from lack of sewerage. We have no underground system, but our surface drainage is fairly efficient and well looked after.

The board has more than once called the attention of the council to the open sewer on Burns avenue, at the crossing of the C. H. & D. R. R. and Section avenue. This sewer has caused some complaint during the hot weather, but the matter seems never to get any further than a conference between the council's committee and the railway officials.

Night soil is removed in covered barrels between the hours of 11 p. m. and 3 a. m.

Contagious diseases are properly reported and recorded, and restrictive measures are usually easily enforced.

Very few vaccinations during the year. Am unable to get a correct estimate, but I know that the schools were thoroughly vaccinated two years ago. It was required by the school board.

The board of health has regular monthly meetings. Only a few times during the year has it failed from lack of a quorum. Our board is in better working order than it has been for a number of years.

Total amount spent, exclusive of salaries, has been \$29.00.

No prosecutions.

Infectious diseases reported during the year: Diphtheria, 3 cases; membranous croup, 1 case; scarlet fever, 1 case.

HASKINS, WOOD COUNTY.

E. B. Holst, M. D., health officer.

Population (estimated) 500.

The sanitary condition of our town has been good the past year. Streets in good condition. Yards are kept clean. We have no alleys. We have no way of sewerage the town except by a big open ditch passing along the main street, which is considered a nuisance by the health board. We have tried to provide a way to put in a brick sewer five feet in diameter, but there is considerable objection to it, as the ditch passes through about twelve miles of farming community before it enters our village, and the farmers claim it will cause an obstruction to the flow of water, and the people of the village think the town cannot afford it. There has also been some steps taken to establish a cut-off above the village and run the water around the town, but the farmers object more to this. There are no arrangements made for the removal and disposal of night-soil and garbage.

Contagious diseases are properly reported and the board has been able to enforce proper restrictive measures. One person was vaccinated during the past year. Out of an attendance of 150 pupils but two are vaccinated. No contagious disease has been prevalent more than usual.

The board has held about six meetings and expended about \$10.00. There have been no prosecutions.

Infectious diseases reported during the year: Scarlet fever, 1 case; typhoid fever, 2 cases.

HAVILAND, PAULDING COUNTY.

E. L. Vermilya, M. D., health officer.

Population (estimated) 300.

Our board of health has only been organized about two months, hence can give only a partial report. Have vaccinated about 25 persons. The number of unvaccinated pupils in the school is 71; vaccinated, 18. We have at present two cases of smallpox.

The board has met three times.

Infectious diseases reported during the year: Smallpox, 2 cases; whooping cough, 1 case. ———

HEBRON, LICKING COUNTY.

Dr. M. L. Scarbrough, health officer.

Population (estimated) 500.

The present sanitary condition of the village is good. Our streets, alleys and yards are all in a cleanly condition. Garbage is hauled away.

The board has not held regular meetings. I cannot give amount spent by the board during the last year.

—————

HICKSVILLE, DEFIANCE COUNTY.

B. L. Kelsey, health officer.

Population (estimated) 2,800.

Streets, alleys and yards are in a fairly good sanitary condition, but there is much complaint of lack of sewerage. We have unsuccessfully tried to abate the nuisance of a filthy open ditch which the council refused to place in a sanitary condition. We have been successful in enforcing proper measures for the prevention of contagious diseases.

Contagious diseases are properly reported and a record kept of the same.

All night-soil and garbage is hauled outside of the village limits and properly cared for. No children have been vaccinated during the year.

The board of health held seven meetings during the year of 1900.

No prosecutions brought by the board during the year.

Infectious diseases reported during the year: Diphtheria, 2 cases; scarlet fever, 2 cases; typhoid fever, 6 cases; measles, 1 case. ———

HILLSBORO, HIGHLAND COUNTY.

Dr. S. R. Howard, health officer.

Population, 4,535.

The sanitary condition of Hillsboro is very fair.

The board of health has maintained an active organization and we have been

successful in enforcing proper measures for the prevention of disease and abatement of nuisances.

We have no system of sewerage save a few lines from court house, city buildings, hotels (2) and an ice plant. Ice plant supplies plenty of water to flush the discharge.

Night soil is removed outside of city and buried.

Contagious diseases are very promptly reported and record kept of such. Restrictive measures are enforced. Diphtheria has been more prevalent than usual. About 40 per cent. of the school children have not been vaccinated.

The board of health has held 18 meetings during year 1900. The board spent \$277.03.

Infectious diseases reported during the year: Diphtheria (membranous croup), 19 cases; scarlet fever, 3 cases; typhoid fever, 2 cases; whooping cough, 1 case.

—————

HOLLANSBURG, DARKE COUNTY.

Dr. A. W. Meek, health officer.

Population (estimated), 350.

We have had a general cleaning up of the streets and alleys, privy vaults, hog pens, etc. There is no complaint on account of sewerage. The citizens complied with all the orders of the board of health.

All contagious diseases have been reported by physicians. The most prevalent contagious disease has been typhoid fever. There were probably four people vaccinated during the year. The superintendent of schools reports 60 unvaccinated children.

The board held six meetings during the year and expended \$35.00.

Infectious diseases reported during the year: Typhoid fever, 6 cases.

—————

HOLMESVILLE, HOLMES COUNTY.

Edgar Cole, M. D., health officer.

Population (estimated), 400.

Streets, alleys and yards are in a cleanly condition. There is no cause for complaint on account of sewerage. The

board has been successful in the abatement of all nuisances. There are no special arrangements for the disposal of night soil and garbage.

Contagious diseases are properly reported and a record kept. Restrictive measures have been enforced. No contagious disease has been unusually prevalent. About twenty-five per cent. of the school children are unvaccinated.

No meetings of the board have been held. Ten dollars was paid to the health officer. No prosecutions.

The health officer has been forced to do all the work of health board and secretary, and he has done his work well, he thinks. The mayor will call the health board together immediately any time there is anything arising that the health officer cannot control. But as long as the board can make the health officer do the work, they intend to make him do it. That is the way it looks to me.

HUDSON, SUMMIT COUNTY.

G. L. Starr, M. D., health officer.

Population (estimated), 1,000.

Present sanitary condition good. Citizens generally co-operate with health board, which has maintained an effective organization. Nuisances generally promptly abated. Defective discharge of sewage has, by persevering care, been corrected in two instances. Night soil removed between setting and rising of the sun to outlying lands.

Contagious diseases reported by physicians or discovered by health officer have been receiving due attention in the way of quarantine and thorough fumigation. Record has been made of the cases. Vaccination has not been enforced, and probably fifty per cent. of school pupils are unvaccinated. The advent of a case of smallpox would make things lively.

Nine or ten meetings of the board have been held and about \$75 expended. Apparatus for vaporizing formaldehyde has been procured and vigorously used. Pig styes and manure piles within the bounds of the corporation are growing rapidly and beautifully less. Hardly a case of typhoid fever from local causes has found place in our record for years,

and from nearly all standpoints our enviable sanitary reputation is being well sustained.

Infectious diseases reported during the year: Diphtheria, 1 case; scarlet fever, 5 cases; typhoid fever, 1 case; mumps, 19 cases; measles, 31 cases.

HUNTSVILLE, LOGAN COUNTY.

J. S. Montgomery, M. D. health officer.

Population (estimated), 700.

The sanitary condition of our village is fair, almost everybody recognizing the importance of strict sanitary conditions in the prevention of disease and for the good of the public health. All nuisances were abated upon notice from board of health.

All contagious diseases are properly reported and quarantined, and a record kept. Scarlet fever has been more prevalent than usual in village and vicinity. About 60 or 75 persons have been vaccinated. The unvaccinated children in school are very few. All have been vaccinated within the last two years.

The board of health has had about four meetings during the year. The amount spent by board of health is about \$15. No prosecutions brought for violation of laws. Our board maintains an active organization and is always ready and willing to act when any sanitary measures are proposed, and uses every effort to see that matters concerning the board are carried out properly. Our people are awake to the good results of the action of the Board of Health and concur in every good movement. This is as it should be; and is a credit to the intelligence and enlightenment of our people.

Infectious diseases reported during the year: Scarlet fever, 6 cases; typhoid fever, 2 cases.

HURON, ERIE COUNTY.

S. H. Lennon, health officer.

Population (estimated), 2,000.

Streets, alleys and yards are in a cleanly condition. There is no complaint because of lack of sewerage. We have been successful in the abatement

of nuisances. There are no arrangements made for the disposal of night soil and garbage.

Contagious diseases are properly reported but no record is kept. The Board has been able to enforce restrictive measures. Diphtheria, scarlet fever and typhoid fever have been more prevalent than usual. So far as known, there were none vaccinated during the year. There are 75 unvaccinated children attending school.

The board of health held five meetings and expended \$75.00. There were no prosecutions.

Infectious diseases reported during the year: Diphtheria, 10 cases; membranous croup, 7 cases; scarlet fever, 5 cases; typhoid fever, 3 cases; whooping cough, 15 cases; measles, 2 cases.

HYDE PARK, HAMILTON COUNTY.

Charles B. Morrell, M. D., health officer.

Population (estimated), 1900.

Our streets, alleys and yards are clean. Many streets are yet unmade, but there is a general disposition to keep the streets and yards in sanitary condition. Our sewerage is bad. Building has increased and the streams have gradually dried up, and what little natural drainage there was is inadequate. We are about to build a system of sewers. Nuisances have been promptly abated. Night soil is removed by permit and is buried at least three feet. We have no regular system for removal of garbage.

Diphtheria, scarlet fever and smallpox are promptly reported by physicians, but they persistently ignore the request to report croup, typhoid fever, whooping cough and measles, and it is almost impossible to enforce the regulation in regard to the latter diseases. Contagious diseases are promptly placarded and the premises kept under the inspection of the sanitary officer, who has disinfected or caused to be disinfected, all premises where there have been contagious diseases. The city of Cincinnati compelled vaccination, which was generally observed.

Our low death rate is due to the fact that several deaths have occurred in the Cincinnati hospitals and have been reported to the Cincinnati Board of Health. We expended about one hundred dollars.

Our health board held but two regular meetings, but the health officer has been in daily touch with them and the office has been as far as possible kept up to standard in all sanitary matters.

Infectious diseases reported during the year: Smallpox, 1 case; diphtheria, 5 cases; membranous croup, 1 case; scarlet fever, 11 cases; typhoid fever, 2 cases; whooping cough, 1 case.

ITHACA, DARKE COUNTY.

J. C. Hamilton, M. D., health officer.
Population (estimated), 250.

The board of health has taken no action during the past year. There have been no contagious diseases.

JACKSON, JACKSON COUNTY.

Henry Simmers, health officer.
Population (estimated), 4800.

Streets and alleys are in good sanitary condition. No cause for complaint from lack of sewerage. No nuisances that the board was not able to abate. Night soil removed in water tight barrels with covers to a farm in the country and buried.

Contagious diseases are promptly reported and record kept. Chickenpox and scarlet fever have been most prevalent last year. There have been about four hundred vaccinated. About three hundred unvaccinated children attend the public schools.

The board of health has held twelve regular and seven special meetings during the year. No prosecutions brought by the board.

Infectious diseases reported during the year: Diphtheria, 7 cases; membranous croup, 2 cases; scarlet fever, 4 cases; typhoid fever, 6 cases; measles, 3 cases; other infectious diseases, 11 cases.

JACKSON CENTER, SHELBY COUNTY.

J. D. Holston, M. D., health officer.
Population (estimated), 700.

Our board has only been organized for a short time—three or four months. Sanitary condition of the village is good. Streets, alleys and yards are clean. No system of sewerage, but a large covered drain carries off surface water. Board has successfully corrected nuisances. Night soil is removed to outlying farms by professionals.

Contagious diseases have been properly reported. Scarlet fever has been prevalent to only a slight extent. No persons have been vaccinated during the year.

The board of health has met monthly since it was organized. Fifteen dollars will probably cover amount spent since organization.

Infectious diseases reported during the year: Scarlet fever, 1 case

JACKSONVILLE, ATHENS COUNTY.

John Stamm, health officer.

Population (estimated), 1000.

Sanitary condition generally good. It has been impossible to maintain an active organization, or even to organize a board of health. The town council took sanitary matters in hand, especially last spring at the time of smallpox scare.

JENERA, HANCOCK COUNTY.

C. H. Heldman, health officer.

Population (estimated), 264.

Sanitary conditions are very good at present. There are no arrangements for disposal of night soil.

Contagious diseases are not properly reported. Measles has been the most prevalent disease. So far as known, no one has been vaccinated.

The board of health held one meeting. Expenses, \$5.00. There were no violations of the health laws or the rules of this board.

Infectious diseases reported during the year: Scarlet fever, 1 case; measles, 1 case.

JERSEY, LICKING COUNTY.

S. S. Richards, M. D., health officer.
Population (estimated), 150.

Our village is in a very good sanitary condition.

Contagious diseases are properly reported and recorded.

Measles have been the most prevalent contagious disease. No vaccinations.

No special meeting. No prosecutions.

About \$10 spent for quarantine and disinfecting.

Infectious diseases reported during the year: Scarlet fever, 2 cases; typhoid fever, 1 case; measles, 18 cases.

JEWETT, HARRISON COUNTY.

Isaiah McMannis, health officer.

Population (estimated), 800.

The village is in good sanitary condition. Our sewerage is improved each year, but we want to do more this year.

The health of our town is good. There is n sickness at present.

Infectious diseases reported during the year: Scarlet fever, 2 cases; typhoid fever, 4 cases.

JUNCTION CITY, PERRY COUNTY.

Dr. J. A. Moody, health officer.

Population (estimated), 600.

Our local board of health has maintained an active organization during the year and has been entirely successful in prevention of contagious diseases and abating nuisances.

Our streets and alleys are properly drained. We have no sewerage. Our closets are merely excavations from 4 to 8 feet deep, and not cemented, but we cannot do any better at this time owing to poverty of owners of property. Our garbage is deposited some distance from town in a vacant lot by the residents of the village at their own expense.

All contagious diseases are reported immediately and measures enforced to prevent spreading. Measles and whooping cough have been a little more prevalent than usual. There has been no vaccination done for several years, but nearly all have been vaccinated and have good scars.

Our board meets when called together for any purpose or as frequently as is necessary. No prosecutions during the year 1900.

Infectious diseases reported during the year: Smallpox, 1 case; diphtheria, 4 cases; scarlet fever, 2 cases; typhoid fever, 24 cases; whooping cough, 26 cases; measles, 20 cases.

KELLEY'S ISLAND, ERIE COUNTY.

Henry Elfers, health officer.

Population (estimated), 1200.

Streets, alleys and yards are in a cleanly condition. There is some complaint on account of sewerage. The board has been unable to abate some nuisances caused by hog pens and out-houses. Night soil and garbage is removed to farms outside the corporation.

Contagious diseases are properly reported and a record kept. The board has enforced restrictive measures.

The board has held only a few meetings during the year. Amount expended, about \$100.

Infectious diseases reported during the year: Diphtheria, 5 cases; scarlet fever, 13 cases; typhoid fever, 2 cases; whooping cough, 13 cases.

KENT, PORTAGE COUNTY.

S. L. Gillette, health officer.

Population (estimated), 4500.

Streets, alleys and yards in good condition. We have no sewerage system. No nuisances which have not been abated. Night soil is moved in tight box wagons made for that purpose.

We are in need of a garbage dump outside of corporation.

Contagious diseases are reported and cards put up, and a strict quarantine enforced in smallpox, scarlet fever and diphtheria.

We have had 6 cases of smallpox, also a number of cases of scarlet fever, but they were very light. About 1200 have been vaccinated. There are only 8 unvaccinated children attending school.

Board of health held 13 meetings during the year. We bought a formaldehyde gas disinfectant, and it is used after every case of infectious disease.

Amount of money spent \$486.25.

Infectious diseases reported during the year: Smallpox, 6 cases; membranous croup, 58 cases; typhoid fever, 1 case.

KENTON, HARDIN COUNTY.

F. H. Fall, health officer.

Population (estimated), 7000.

Our streets and alleys are in good shape.

We have had 50 cases of typhoid fever. In almost every case the family used water from dug wells, and was outside of the sewer district. We have at present 5 cases of smallpox, but are taking every precaution to prevent it from spreading.

Our board of health meets regularly the first Monday of each month, and between times when needed.

Infectious diseases reported during the year: Smallpox, 4 cases; diphtheria, 4 cases; scarlet fever, 13 cases; typhoid fever, 50 cases; measles, 3 cases.

KIRBY, WYANDOT COUNTY.

Dr. E. E. Burns, health officer.

Population (estimated), 167.

Sanitary condition good. Streets are in fair condition. Sewers are kept in working order.

We have had 12 cases of scarlet fever during the year. There has been but one person vaccinated.

KOSSUTH, AUGLAIZE COUNTY.

Thos. J. Barnett, health officer.

Population (estimated), 200.

Streets are in fair condition. There are no arrangements for the disposal of night soil or garbage.

Contagious diseases are properly reported, but no record is kept. We have enforced restrictive measures. Scarlet fever of a mild form has been more prevalent than usual.

The Board held two meetings and expended \$15. No prosecutions.

Infectious diseases reported during the year: Scarlet fever, 5 cases.

LAKESIDE, OTTAWA COUNTY.

Peter F. Hoibye, health officer.

Population (estimated), during July and August from 2500 to 3000.

The streets and alleys are in good sanitary condition. One-half of the grounds is sewered. The other half use buckets for closets. The buckets are emptied once a week and the night soil is hauled a mile and a half from the grounds. The same is disinfected. Garbage is removed in June 3 times a week, in July and August daily and in September 3 times a week.

Compelled two parties this season to connect with sewer.

LAKESIDE, CUYAHOGA COUNTY.

A. E. McClure, M. D., health officer.

Population (estimated), 3,500.

Infectious diseases reported during the year: Smallpox, 3 cases; diphtheria, 2 cases; membranous croup, 1 case; scarlet fever, 20 cases; typhoid fever, 8 cases; whooping cough, 15 cases; measles, 12 cases.

LANCASTER, FAIRFIELD COUNTY.

F. P. Stukeby, M. D., health officer.

Population (estimated), 10,000.

Streets, alleys and yards are in fair condition, however, there is room for improvement in this line and noticeable progress is being made from year to year. There has been no improvement in our sewerage system. The Board has been successful in abating nuisances. No special arrangement has been made for the removal of night soil and garbage.

Contagious diseases are reported and a record of the same is kept. The board has been able to enforce proper restrictive measures. There were no vaccinations during the past year. About 350 children are attending the schools who have not been vaccinated.

The board held eight meetings during the year and expended \$1696.78. No prosecutions were brought during the year.

Infectious diseases reported during the year: Diphtheria, 5 cases; membranous croup, 6 cases; scarlet fever, 8 cases; measles, 4 cases.

LA RUE, MARION COUNTY.

Robert J. Myers, health officer.

Population (estimated), 1,200.

We have an active organization and have been fairly successful in enforcing proper measures for the prevention of contagious diseases and abatement of nuisances.

Streets, alleys and yards are in a cleanly condition. There is no complaint on account of sewerage. We have had trouble with the C. C. C. & St. L. R. R. They have a water jack by which they wash out the filth from their hog cars in hot weather while throwing water on the hogs being shipped over the road. They pay no attention to notices to cut weeds, and do not want to clean their water closet more than once a year. We have night

soil and garbage removed out of corporation at night.

There have been no contagious diseases to report since my term of office. I cannot tell how many have been vaccinated, but do not think any have been during the year.

The board held three meetings. The board viewed the village twice, and I, as health officer, have served 140 notices.

LAURA, MIAMI COUNTY.

S. P. Neff, M. D., health officer.

Population (estimated), 375.

The council here has lately chosen a board of health.

The board has adopted the rules and regulations as given by State Board.

Our village heretofore has not maintained a board of health, therefore no measures were taken for the prevention of contagious diseases or for the abatement of nuisances.

Our main streets are in a fairly clean condition, but some of the alleys and some of the vacant lots are not so.

There is no cause for complaint about the sewerage. The garbage is hauled away to fields.

Contagious diseases are not properly reported. There is no record of such diseases kept. There have not been proper restrictive measures enforced. Measles and influenza have been more prevalent than usual. There hasn't been any vaccination done within the last year.

LAURELVILLE, HOCKING COUNTY.

J. S. Haynes, health officer.

Population (estimated), 600.

Sanitary condition good. The Board has been in active organization and is successfully enforcing proper measures for prevention of contagious diseases and abatement of nuisances.

Streets, alleys and yards are clean. We have no sewerage and there is some complaint in regard to this. There

are no nuisances which the board has unsuccessfully tried to abate. No arrangements made for disposition of night soil or garbage.

Contagious diseases are properly reported and a record is kept. Restrictive measures are enforced. The most prevalent contagious disease has been scarlet fever. No vaccination. Cannot get report of number of unvaccinated children attending school.

The board held 12 meetings. Amount spent, \$104.75. There were no prosecutions.

Infectious diseases reported during the year: Scarlet fever, 13 cases; typhoid fever, 1 case.

LEBANON, WARREN COUNTY.

G. M. Curry, M. D., health officer.

Population (estimated), 3,000.

The sanitary condition of the village is considered good. The streets and alleys are clean and no individual complaints made. The board has been successful in the abatement of nuisances. The removal of night soil is under the supervision of the health officer, and is disposed of within prescribed hours.

Contagious diseases are promptly reported, but for the past year no contagious disease has been epidemic.

The board of health held four meetings last year, and the total amount expended was \$40. No prosecutions brought by the board for violations of its orders.

Infectious diseases reported during the year: Scarlet fever, 3 cases; measles, one case.

LEESBURG, HIGHLAND COUNTY.

Dr. H. A. Beeson, health officer.

Population (estimated), 1,000.

This has been a very healthful year. Except in case of an epidemic it is not easy to have meetings of a board of health in a village throughout the year. I believe it would very much improve the effectiveness and promptitude of

village boards of health if such boards were organized with a working majority of female members.

Very few meetings were held, not more than 3. Don't know of any money expenditure by the board officially, the past year.

Infectious diseases reported during the year: Scarlet fever, 2 cases; typhoid fever, 3 cases.

LEETONIA, COLUMBIANA COUNTY.

Dr. H. B. Kurtz, health officer.

Population (estimated), 3,500.

Streets, alleys and yards are in a cleanly condition. There is no complaint from lack of sewerage. There have been no nuisances which the board has unsuccessfully tried to abate. Night soil is removed in air-tight barrels.

Contagious diseases are properly reported. A record of such is kept. Restrictive measures have been enforced. Typhoid fever has been the most prevalent contagious disease. It is impossible to give the number of people vaccinated during the year.

The board held 12 meetings and expended \$235. No prosecutions.

Infectious diseases reported during the year: Diphtheria, 1 case; scarlet fever, 4 cases; typhoid fever, 18 cases; mumps, 10 cases.

LXINGTON, RICHLAND COUNTY.

Dr. H. H. Smith, health officer.

Population (estimated), 432.

We have had no contagious diseases except one case of scarlet fever. Quarantine and disinfection completely eradicated that as no other cases occurred. I have no doubt but that every body would vaccinate at once if a case of smallpox should occur in this community, otherwise they will strenuously object on the ground that recent vaccination has greater protective powers, as that seems to be the excuse offered.

There seems to be 106 pupils in the school not vaccinated. This fact the board regrets being nearly two-thirds of the school. We are waiting for some auspicious moment to pounce upon them. The cleaning up of streets and alleys and distribution of chloride of lime is the method of the village for disinfection.

Regular meetings of the board of health have not been held, as the work of looking after these matters has largely been left to the village marshal and health officer. Reports of nuisances etc. are always reported to them and when trouble is likely to arise, a meeting of the board is called, and committees appointed to assist the above named officers in the enforcement of the law.

Infectious diseases reported during the year: Scarlet fever, 1 case:

LIMA ALLEN COUNTY.

L. F. Laudick, M. D., health officer.

Population (estimated), 25,000.

Infectious diseases reported during the year: Diphtheria, 53 cases; membranous croup, 1 case; scarlet fever, 153 cases; whooping cough, 15 cases; measles, 399 cases.

LISBON, COLUMBIANA, COUNTY.

W. C. Sufflee, health officer.

Population, 3,333.

The streets and alleys are in good condition. There is cause for complaint because of a sewer discharging its contents into Little Beaver creek over a large rock about eight feet above the water and the sewage consequently exposed to the open air before striking the water. Another sewer in the north part of town empties into an ordinary drain or gutter at the side of a public street away from any stream of water and directly in front of a number of

dwellings and the board of health of this village has not made any attempt to abate the nuisance although requested to do so by citizens and myself several times.

Contagious diseases are properly and promptly reported to me, but I am pleased to say, the village has been remarkably free from the same as will be seen by my report.

The board of health has only had three or four meetings during the year and has not been able to get a quorum since August, consequently have had no meeting. No money has been expended except one hundred and thirty dollars—health officers salary and sixty dollars salary of the secretary of the board. No prosecutions have been made by the board during the year.

About fifty earth closets have been ordered cleaned by me and my order complied with in every instance.

Infectious diseases reported during the year: Scarlet fever, 2 cases.

LOCKLAND, HAMILTON COUNTY.

M. Guth, health officer.

Population (estimated) 3,000.

Infectious diseases reported during the year: Diphtheria, 1 case; typhoid fever, 2 cases.

LODI, MEDINA COUNTY.

H. Selders, health officer.

Population (estimated) 950.

The board held eight meetings. Amount expended, \$125.00. There are 73 unvaccinated children attending school.

LONDON, MADISON COUNTY.

M. Vance, M. D., health officer.

Population (estimated) 3,700.

Our board has kept up a good organization. The sanitary condition of the town is good, with the exception of our

two open drains, which were investigated by your Engineer. The board has taken no action on your recommendation.

Contagious diseases are reported and quarantined successfully.

The board meets from once to twice a month. I do not know what the expenditures are for the year, as bills are handed to council and paid there.

One arrest during last year.

Infectious diseases reported during the year: Scarlet fever, 9 cases.

Our board does not enforce births and deaths to be reported, only infectious diseases.

LORAIN, LORAIN COUNTY.

S. S. Cox, M. D., health officer.

Population (estimated) 17,000.

Streets and alleys are not very clean. Night soil is removed at expense of property owners for fifty cents per barrel. Garbage is removed at expense of city.

Contagious diseases are reported and records are kept of same. No trouble to enforce restrictive measures.

The board of health has held twenty-four meetings during 1900.

Total amount spent by board during 1900 for all purposes, including \$2,200 for pest farm, \$8,148.20.

Infectious diseases reported during the year: Smallpox, 73 cases; diphtheria, 62 cases; scarlet fever, 51 cases; typhoid fever, 2 cases; measles, 14 cases; other infectious diseases 32 cases.

Three of the smallpox cases were very doubtful.

LOUDONVILLE, ASHLAND COUNTY.

Wm. Conrad, health officer.

Population (estimated) 1,500.

Our village is in a good sanitary condition. Streets and alleys are kept clean. The health board has succeeded within a few months in procuring a dumping ground where all refuse matter and

garbage shall be conveyed and covered with soil, including night soil which is buried in trenches dug for that purpose.

There should be more prompt reports made of contagious diseases by physicians.

There have been sixteen meetings of the board of health.

As only one child under a year of age died during the last year and the next youngest person that died was 23 years and 7 months old, this would indicate that there had been no epidemics here. We rigidly quarantined the diphtheria cases, four in one home and kept the disease from spreading. There was only one case of typhoid fever in past year. The superintendent of the school made report this morning as follows: "Of about 360 enrolled, 258 have never been vaccinated."

Infectious diseases reported during the year: Diphtheria, 4 cases; scarlet fever, 3 cases; whooping cough, 6 cases; measles, 2 cases; other infectious diseases, 3 cases.

LOUISVILLE, STARK COUNTY.

C. A. Walker, M. D., health officer.

Population (estimated) 1,500.

Sanitary condition good.

Contagious diseases are not reported as they should be. We are taking a step now which probably will be a good one. We expect to print a pamphlet, giving time of quarantine for each contagious disease and the penalty for not conforming to the laws, which will be given to each family when quarantined. Our difficulty is to enforce quarantines the required time.

The board has held two meetings.

Expenditures about \$700.

Infectious diseases reported during the year: Diphtheria, 2 cases; scarlet fever, 10 cases; measles, 2 cases.

LOWELL, WASHINGTON COUNTY.

Geo. A. Phillips, M. D., health officer.
Population (estimated) 400.

Our town is in good sanitary condition. We have a board of health, but usually there is so little for it to do that it seldom meets. When called upon it is always ready to enforce measures for the prevention of the spread of contagious diseases. We have no system of sewerage. Garbage is usually thrown on manure piles and hauled away now and then.

Contagious diseases are reported as a general thing, but we have had nothing dangerous in the last year.

I think no children were vaccinated in the last year. A great many have never been vaccinated. The board pays a salary of \$25.00 to the health officer.

Infectious diseases reported during the year: Typhoid fever, 5 cases; measles, 6 cases.

LOWELLVILLE, MAHONING COUNTY.

J. H. M. Williams, health officer.

Population (estimated), 1,137.

Our streets, alleys and yards are kept in fairly clean condition. No sewerage, except drainage from the town to river. All nuisances known to exist have been abated without prosecutions. Night soil is removed in covered tank wagon. Have good garbage dump.

Contagious diseases are reported and somewhat of a record kept.

All orders of the board have been enforced peaceably. Board held five meetings. Spent \$13.02.

Infectious diseases reported during the year: Diphtheria, 9 cases; membranous croup, 2 cases.

LOWER SALEM, WASHINGTON COUNTY.

W. S. Williams, M. D., health officer.

Population (estimated), 190.

There is no organization of health board, and of course no meetings held. The town council acts as the health board. There is no sewerage system. The removal of night soil is left to each

individual. The streets and alleys are kept in fairly good condition.

We have had but very little trouble with contagious diseases.

Infectious diseases reported during the year: Typhoid fever, 11 cases; measles, 8 cases.

LYNCHBURG, HIGHLAND COUNTY.

Jerry Archer, health officer.

Population (estimated), 1,000.

Streets, alleys and yards are in fairly good condition. There is some ground for complaint of the lack of sewerage. The board has successfully abated the nuisance caused by a cesspool of the distillery belonging to Freiberg and Workum, by removing the contents and disinfecting the premises with a solution of lime and copperas. Night soil and garbage is removed by private parties under the supervision of the board.

Contagious diseases are reported. No record has been kept.

Board has had six meetings. \$50.00 expended.

McARTHUR, VINTON COUNTY.

Walter B. Lyle, health officer.

Population (estimated), 1,000.

Streets, alleys and yards are in a fair condition. We have no sewerage. All nuisances reported were successfully abated. No arrangements for disposition of garbage, etc.

Contagious diseases are properly reported, but no record kept. Had quite a number of cases of whooping cough, and ten cases of scarlet fever.

Board of health held twelve meetings. Spent \$70. No prosecutions.

Infectious diseases reported during the year: Scarlet fever, 10 cases.

McCOMB, HANCOCK COUNTY.

J. A. Howell, M. D., health officer.

Population (estimated), 1,200.

Sanitary condition of streets and alleys is good. No complaint from lack

of sewerage. No nuisances but what have been abated successfully. Night soil and garbage is removed to dumping ground, controlled by the village, in closed barrels.

Contagious diseases are properly reported and record kept. The board has been able to enforce all necessary restrictive measures. Diphtheria has been most prevalent. About twenty-five persons were vaccinated during the year. Thirty-five children attending school have not been vaccinated.

The board has met ten times and spent \$225.00 during the last year. No prosecutions by the board the past year.

Infectious diseases reported during the year: Diphtheria, 50 cases; typhoid fever, 10 cases; whooping cough, 20 cases.

McCONNELSVILLE, MORGAN COUNTY.

Wm. Dille, health officer.

Population (estimated), 2,000.

Infectious diseases reported during the year: Diphtheria, 14 cases; membranous croup, 1 case; scarlet fever, 1 case; typhoid fever, 4 cases; whooping cough, 16 cases; measles, 24 cases.

McGUFFEY, HARDIN COUNTY.

Dr. J. B. K. Evans, health officer.

Population (estimated), 350.

The sanitary condition is good.

Contagious diseases are reported promptly. The board has been able to enforce quarantine. Smallpox has been more prevalent than usual. About 75 have been vaccinated the past year.

The board has spent about \$125.00.

Infectious diseases reported during the year: Scarlet fever, 5 cases; typhoid fever, 35 cases; smallpox 29 cases.

MADISONVILLE, HAMILTON COUNTY.

C. L. Metz, M. D., health officer.

Population (estimated), 4,000.

The town is in an excellent sanitary condition. Vaults are inspected every four months. When two-thirds full are required to be cleaned at expense of owner. Night soil is removed outside of the town limits and buried in trenches and covered with soil. Gutters are flushed whenever ordered by the health officer. Contagious diseases are reported at once to the health officer by attending physician. A fine is imposed on those failing to do so. All children admitted to the public school are required to bring certificate of vaccination.

Board of health meets regularly 2nd Monday of every month.

The expenses of the board for the year were about \$500.

The board, council, school boards and directors of parochial schools all work together for the common good and we have no trouble to enforce ordinances or the regulations of the board of health.

Infectious diseases reported during the year: Smallpox, 1 case; diphtheria, 4 cases; scarlet fever, 1 case; typhoid fever, 8 cases; whooping cough, 1 case; measles, 4 cases.

MAGNOLIA, STARK AND CARROLL COUNTIES.

Solon Zentz, clerk board of health.
Population (estimated), 800.

The present sanitary condition of our village is good. Our board of health has maintained an active organization and been successful in enforcing proper measures for the prevention of contagious diseases, and the abatement of nuisances. Our streets, alleys and yards are in a fairly clean condition for this time of year.

Contagious diseases are properly reported but there is no record kept, except in the minutes of our meetings and in the records of death. The board has been able to enforce proper restrictive measures. Only about one-third of our inhabitants are vaccinated, and all need to be vaccinated over. We have about two hundred school children and very few have been vaccinated.

We have regular meeting nights every month and called meetings when necessary.

MANSFIELD, RICHLAND COUNTY.

J. Harvey Craig, M. D., health officer.
Population (estimated), 20,000.

Streets, alleys and yards are in a cleanly condition. There is cause for complaint on account of lack of sewerage. The board has been successful in the abatement of nuisances.

A record of contagious diseases is kept, which are properly reported. Restrictive measures have been enforced. Diphtheria has been more prevalent than usual.

The board during the year held six meetings.

Infectious diseases reported during the year: Diphtheria, 81 cases; membranous croup, 2 cases; scarlet fever, 100 cases; typhoid fever, 30 cases; whooping cough, 200 cases; measles, 117 cases; other infectious diseases, 54 cases.

MARBLEHEAD, OTTAWA COUNTY.

A. J. Clemons, health officer.
Population (estimated), 1,200.

No cases of infectious diseases were reported to me during the year.

MARIETTA, WASHINGTON COUNTY.

Dr. J. B. McClure, health officer.
Population (estimated), 14,000.

Infections diseases reported during the year: Smallpox, 6 cases; diphtheria, 7 cases; membranous croup, 4 cases; scarlet fever, 50 cases.

MARION, MARION COUNTY.

E. H. Raffensperger, D. D. S., health officer.

Population (estimated), 12,000.

Streets, alleys and yards in good condition. No cause for complaint of lack of sewerage, but complaint is made by farmers along the Little Scioto river, regarding the discharge of the sewage into that stream. The board has successfully abated all nuisances brought to its notice. Regular scavengers with water-tight barrels remove all night soil and garbage, and haul it several miles from the city, where it is placed on farms with the owners' consent.

Contagious diseases are promptly reported and a record is kept of all cases, and the houses carded. The board has had no trouble in enforcing proper restrictive measures. Measles and scarlet fever have been more prevalent than usual during the year. Can give no idea of the number of persons vaccinated during the year, or of the number of pupils not vaccinated attending school.

The board of health has held 14 meetings during the year and spent for all purposes \$1,126.95. Five persons were prosecuted during the year for not cleaning privy vaults and depositing garbage in a stone quarry in the city limits. In each case the party agreed to comply with the orders of the board.

Infectious diseases reported during the year: Smallpox, 2 cases; diphtheria, 12 cases; membranous croup, 1 case; scarlet fever, 41 cases; typhoid fever, 21 cases; measles, 24 cases; other infectious diseases, 1 case.

MARTIN'S FERRY, BELMONT COUNTY.

J. W. Darrah, M. D., health officer.
Population (estimated), 8,000.

Streets in a fairly good condition. No cause for complaint for lack of sewerage. No nuisances abated. Night soil taken to country and buried.

All contagious diseases reported and a record kept. Diphtheria prevalent.

Only about 15 unvaccinated children attending public school.

Board of health meets monthly. Have spent about \$200. No prosecutions.

Infectious diseases reported during the year: Smallpox, 6 cases; diphtheria, 45 cases; membranous croup, 7 cases; scarlet fever, 1 case.

MARYSVILLE, UNION COUNTY.

Jno. E. Wood, M. D., health officer.
Population (estimated), 3,048.

Streets and alleys and yards are cleaned twice a year by order of the board, and so far as we know are in good condition now. We have no adequate system of sewerage, but have had no complaints which have not been satisfactorily adjusted.

The town has a dump outside the village limits for night soil and garbage.

The town had no contagious diseases, with the exception of measles, of which we have had a great number of cases but no deaths. Many were reported, but were unable to quarantine all, or to know of all cases, but all suspected cases were kept out of school by superintendent.

The board has had six meetings, besides some special ones, and are willing to meet when there is any business to attend to. Am unable to state the number of unvaccinated children. Board has expended \$202.55.

Infectious diseases reported during the year: Measles, 40 cases.

MASON, WARREN COUNTY.

Dr. C. T. Hall, health officer.
Population (estimated), 630.

Streets and alleys are in a cleanly condition. No complaints concerning sewage made. The board has successfully abated all nuisances.

All contagious diseases are properly reported. Records are kept of nearly all diseases. The board has been successful in enforcing restrictive measures.

The board aims to have 12 meetings (one each month). The total amount spent during year, \$10.00.

MASSILLON, STARK COUNTY.

T. Clarke Miller, M. D., health officer.
Population (estimated), 13,500.

Streets and alleys kept in a fairly good condition. Thorough house to house once a year. Thorough "cleaning up" required and accomplished. Sewers not accessible to over one-fifth of the population. An old outlet of the sewer is quite objectionable, because a number of connected people have not abandoned it and it empties where it ought not, though no harm has resulted so far. The board of health has had very good success and is usually obeyed. Night soil is distributed on farm lands outside the city limits. Contagious diseases are reported and a record is kept. We have been able to enforce restrictive measures. We have had more typhoid fever than usual. There have not been many persons vaccinated during the year. It is about an impossibility to determine the number of unvaccinated pupils in the schools. If the rules of the schools were enforced, there would be practically none. In fact, there are a good many. There have been no prosecutions during the past year.

Infectious diseases reported during the year: Diphtheria and membranous croup, 23 cases; scarlet fever, 5 cases; typhoid fever, 44 cases; measles, 3 cases.

MAUMEE, LUCAS COUNTY.

P. Hartman, health officer.
Population (estimated), 1,980.

Streets, alleys, etc., in fair condition. There is cause for complaint for lack of sewerage.

Contagious diseases are properly reported.

Ten meetings of the board were held. Regular meeting is last Thursday of each month. Money spent by the board, \$86.56.

Infectious diseases reported during the year: Scarlet fever, 7.

MECHANICSBURG, CHAMPAIGN COUNTY.

Dr. John C. Hathaway, health officer.
Population (estimated), 2,000.

Streets and alleys kept clean. No complaint from lack of sewerage. All nuisances are abated. Night soil and garbage removed by contract to a field one mile from corporation.

Contagious diseases are reported and a record kept. Measles most prevalent. Five or six vaccinated.

Five meetings held during year. All bills are presented to council. No prosecutions brought by board.

Infectious diseases reported during the year: Scarlet fever, 10 cases; typhoid fever, 4 cases; measles, 20 cases.

MEDINA, MEDINA COUNTY.

F. L. Harding, health officer.
Population (estimated), 2,300.

Our town is in good shape, clean and in a healthy condition, excepting a few cess-pools, and we lack for proper sewerage. The board have performed their duty faithfully. There have been no prosecutions. Amount expended about \$100.00. Can't give the number of people vaccinated, but not many. Contagious diseases are properly reported and a record of same kept.

Infectious diseases reported during the year: Smallpox, 1 case; diphtheria, 1 case; scarlet fever, 8 cases; typhoid fever, 6 cases; whooping cough, 2 cases; measles, 2 cases.

MELROSE, PAULDING COUNTY.

Thos. J. Myers, health officer.
Population, 383.

Our village is in a nice, clean condition. We allow no filth to accumulate in the yards or alleys. I look after matters very closely.

Proper restrictive measures are immediately enforced upon the report of any contagious disease.

The board held 12 meetings and expended \$7.00. One prosecution was brought for violation of quarantine and fine imposed.

Infectious diseases reported during the year: Typhoid fever, 1 case; whooping cough, 3 cases; measles, 2 cases.

MENDON, MERCER COUNTY.

Dr. W. P. Clay, health officer.

Population (estimated), 700.

Sanitary condition is fair as to streets, alleys and yards. We have no sewerage system and no arrangements as to disposition of night soil and garbage.

Contagious diseases are only partly reported. Membranous croup and typhoid fever have not been reported. Births and deaths have not been reported. A record is kept of reported cases. We have had no trouble in enforcing quarantine and disinfection in diphtheria cases. Very few have been vaccinated. About 200 unvaccinated children are in school.

Board of health has had only two or three sessions and have not yet acted on bills. Total expense of quarantine and disinfection will be about ten dollars.

Infectious diseases reported during the year: Diphtheria, 9 cases; typhoid fever, 2 cases.

MENTOR, LAKE COUNTY.

L. H. Lusc, M. D., health officer.

Population (estimated), 600.

Streets, alleys and yards are in a cleanly condition. There is no complaint from lack of sewerage or improper discharge of sewage. There are no unsuccessfully abated nuisances. There are no arrangements for the removal and disposition of night soil and garbage.

We have not had any contagious diseases this year, but when such occur a proper record is kept and restrictive measures are enforced. All children attending school are vaccinated so far as known.

There were three meetings held, and the board expended \$10.00 during the year. There were no prosecutions.

We as a village have been very fortunate. Have not had a single case of contagious or infectious disease the past year. Only one nuisance, that is Presley's slaughter house, and that has been kept better the past year than ever before.

METAMORA, FULTON COUNTY.

B. M. Blaine, health officer.

Population (estimated), 450.

Our streets and alleys are in perfect condition.

Contagious diseases none.

The board has met at regular intervals and the total amount of expenditures was twenty dollars.

MIAMISBURG, MONTGOMERY COUNTY.

Dr. C. F. Ginn, health officer.

Population (estimated), 4,000.

Sanitary condition is good. Need some improvement in the sewerage. We have been able at all times to abate all nuisances. All night soil is hauled outside corporation and buried.

Contagious diseases are supposed to be reported but at present have not been keeping a record. The board has no trouble in restricting contagious diseases.

Board has held 14 meetings during the year. Have not had any prosecutions.

MIDDLEPORT, MEIGS COUNTY.

David Sisson, health officer.

Population (estimated), 3,000.

Streets, alleys and yards are in fairly clean condition. There is no cause for complaint from lack of sewerage. The removal of night soil is done at the order of the health officer.

No contagious diseases occurred during the year except whooping cough and mumps and these are not reported. The board is perfectly able to enforce restrictive measures when needed. No vaccinating was done during the year that came to the knowledge of the health officer. There are from 300 to 400 unvaccinated children attending school.

There were two meetings of the board of health. No prosecutions were brought and no expense was incurred for any purpose during the year, except salary of health officer and clerk, which are nominal.

MIDDLETOWN, BUTLER COUNTY.

Dr. G. D. Lummis, health officer.
Population (estimated), 10,000.

Streets, alleys and yards are in a cleanly condition and sewerage good.

Contagious diseases are promptly reported, and a record of such diseases kept. Very few children in schools not vaccinated as all were vaccinated during winter of 1899.

Board of health meetings subject to call of health officer. Board expended during 1900 for all causes \$635.53.

Infectious diseases reported during the year: Smallpox, 2 cases; diphtheria, 10 cases; scarlet fever, 7 cases; typhoid fever, 2 cases.

MILLERSBURG, HOLMES COUNTY.

C. J. Fisher, health officer.
Population (estimated), 2,200.

Infectious diseases reported during the year: Diphtheria, 4 cases; scarlet fever, 18 cases; typhoid fever, 2 cases.

MINERAL RIDGE, TRUMBULL COUNTY.

J. M. Elder, M. D., health officer.
Population (estimated), 1,100.

Our village was never in a better sanitary condition. Streets and alleys are in excellent condition.

The board meets regularly every month and abates all nuisances detrimental to health. We had one case of confluent smallpox with one death. We kept the disease confined to the house in which it broke out. The total expense for maintaining the board including smallpox case \$4.50.

Infectious diseases reported during the year: Smallpox, 1 case; typhoid fever, 20 cases.

MINERVA, STARK COUNTY.

J. C. Young, health officer.

Population (estimated), 1,500.

I have very little to report, as we can't get our mayor to take any steps to have the board of health have any meetings. We have had no meetings in last year, and all the work that has been done is only what I have had come to my notice. Our city has been very lucky but the time is coming when they must be prepared.

MONTPELIER, WILLIAMS COUNTY.

H. W. Wertz, M. D., health officer.

Population (estimated), 2,200.

Our sanitary condition is fairly good, with the exception of our sewerage. We have practically no system at all.

The board met once last year.

Infectious diseases reported during the year: Membranous croup, 1 case; scarlet fever, 1 case; typhoid fever, 2 cases; whooping cough, 10 cases; measles, 6 cases; other infectious diseases, 1 case.

MORROW, WARREN COUNTY.

E. Wilkerson, health officer,
Population (estimated), 900.

Streets, alleys and yards are in a cleanly condition. There is no com-

plaint on account of sewerage. Notice was served on the proprietor of a canning house as to green corn husks and cobs at their factory. Same not removed. Garbage is removed twice per week in summer and once per week in winter.

Contagious diseases are properly reported and a record of same is kept. The board has been able to enforce restrictive measures. There are 131 unvaccinated children attending public schools.

Board of health held three meetings. There was no money expended. No prosecutions.

MT. BLANCHARD, HANCOCK COUNTY.

Dr. R. N. Lee, health officer.

Population (estimated), 600.

The board of health has been successful in preventing all contagious diseases and in enforcing the laws of the State Board in the abatement of nuisances. There have been no persons vaccinated during the year.

The board of health has held five meetings. No prosecutions.

The streets, alleys and yards are in good condition. No complaints to offer. The board has expended \$2.00

MT. HEALTHY, HAMILTON COUNTY.

Dr. Jacob Ferris, health officer.

Population (estimated), 1,500.

Sanitary condition fairly good. Streets and alleys tolerably clean. No filth. Sewers, none. There is cause for complaint. We need sewers. The board is successful in the abatement of nuisances. Garbage and night soil are removed to the country, mixed with other fertilizer and then used.

Contagious diseases are reported properly and quarantine rules observed. A record has not been kept until last year or so. We had a few cases of

diphtheria. Vaccinations have been few the past year, as in previous years, it has been well attended to. No trouble here in enforcing vaccination. Very few if any unvaccinated pupils attending school.

Until our new mayor, C. W. Paris, was installed in office after last spring election, the board of health had ceased to meet at all and was practically defunct. Now we have, since last June, monthly meetings.

Infectious diseases reported during the year: Diphtheria, 6 cases.

MT. PLEASANT, JEFFERSON COUNTY.

T. P. Gorsuch, health officer.

Population (estimated), 700.

Our town is in a very good sanitary condition at the present time. We have maintained our organization by the board delegating full power to the health officer and clerk to attend to all cases that may need attention, and to call meeting of board for consultation if they think best.

We have been very successful in preventing the spread of contagious diseases. Contagious diseases are mostly properly reported. Typhoid fever has not been reported as it should have been. When reported, or we have knowledge of cases, we have no trouble to enforce proper restrictive measures. Scarlet and typhoid fever have been the only contagious diseases we have had. No one vaccinated during the year.

Have not had much trouble with nuisances. Streets, alleys and yards are in fair condition for the season of the year. We have a general clean-up in the spring, and try to have them kept so during the summer. We have no system of sewerage. Being on a hill, we have natural drainage. Have no system to dispose of garbage. Mostly thrown on manure heap and hauled away.

The board has only met once during the year. The health officer and clerk did not need to call them.

Our expenses have been \$40. Have not had any prosecutions.

Infectious diseases reported during the year: Scarlet fever, 2 cases; typhoid fever, 15 cases.

MT. STERLING, MADISON COUNTY.

Dr. Chas. T. Gallagher, health officer.

Population (estimated), 2,000.

Streets, alleys and yards are in fair sanitary condition. Sewerage very imperfect. No complete system.

Contagious diseases are not all reported properly. There were probably 50 vaccinations during the year.

Board met seven times during the year.

Infectious diseases reported during the year: Diphtheria, 4 cases; membranous croup, 1 case; typhoid fever, 2 cases; whooping cough, 45 cases.

MT. VERNON, KNOX COUNTY.

Dr. Harry W. Blair, health officer.

Population (estimated), 7,500.

The streets, alleys and yards are kept free from garbage. The sewerage is ample. No special difficulty in abating nuisances. The garbage and night soil is partly hauled to farms for fertilizer. The balance is burned or buried at the city garbage grounds.

Contagious diseases are usually reported promptly and measures enforced to prevent their spread. Typhoid fever has been more prevalent than usual. About 75 have been vaccinated during the year.

The board has met regularly once each month and has held one or two special meetings. No prosecutions. Expenses, about \$750.00.

Infectious diseases reported during the year: Diphtheria, 5 cases; scarlet fever, 3 cases; typhoid fever, 27 cases; whooping cough, 20 cases.

MOUNT WASHINGTON, HAMILTON COUNTY.

Dr. W. C. Langdon, health officer.

Population (estimated), 800.

Sanitary condition good. Board has maintained an active organization and has been successful in enforcing proper measures for the prevention of contagious diseases and the abatement of nuisances. Streets, alleys and yards are clean. No complaints on account of lack of sewerage. No arrangements are made for the removal and disposition of night soil and garbage.

Contagious diseases are properly reported. No record of same is kept. Typhoid fever and scarlet fever have been most prevalent. Four meetings. Expenses, \$50.44.

MURRAY CITY, HOCKING COUNTY.

Dr. T. J. Dillinger, health officer.

Population (estimated), 1,200.

The sanitary conditions are not very good but the health of the village is very good at present.

Our streets, alleys and yards are in just ordinary condition for a mining town. In some places the sewerage is not above complaint. We have abated all nuisances without a law-suit.

Much of the night soil and garbage is buried and the rest is hauled off by the street commissioner.

All diseases of a contagious nature are not properly reported. Some physicians from neighboring towns are called in purposely to keep from quarantining the house. I quarantine every case of contagious disease in the town if I hear of it. There is no accurate record kept of all contagious diseases. We have no book for that purpose.

The board or myself has enforced all restrictive measures. Smallpox and scarlatina have been most prevalent. About 100 persons were vaccinated this year. I presume about 150 pupils attending school have never been vaccinated.

The board of health has had about 10 meetings within this year. More than usual.

The board has spent about \$1,200.

We have had no prosecutions by the board of health this year.

Infectious diseases reported during the year: Smallpox, 20 cases; scarlet fever, 22 cases; whooping cough, 30 cases; measles, 2 cases.

NAPOLEON, HENRY COUNTY.

O. E. Barnes, health officer.

Population (estimated), 4,000.

The present sanitary condition of the village is very good. The board has maintained an active organization, and has been successful in enforcing proper measures for prevention of contagious disease. Quite a number of our citizens and especially children were vaccinated last March and April. At the time there were so many cases of smallpox reported in the south part of our county. The superintendent of our school reports there must have been 550 vaccinated, out of 726 now enrolled as school children. I think there is no cause for complaint from the lack of sewerage, as there has been put in some two or three hundred rods of sewers the past year. No nuisance which the board has unsuccessfully tried to abate.

Contagious or infectious diseases are reported properly, I think, with the exception of whooping cough. Record of contagious diseases is kept. All night soil removed with approved airtight barrels. Removal regulated by ordinance, and done under inspection of the health officer. All night soil removed two miles from the corporation and buried. Garbage deposited on a dump ground outside of corporation and near no residence.

Time of regular meetings of the board, the last Friday of the month. Number of meetings held during the year with quorum, 13. The board has spent during the last year about \$450.

The cause of the additional expense from last year was the expense of the sanitary guards at the time of the smallpox scare in the south part of our county.

No prosecutions for violations of health laws.

Infectious diseases reported during the year: Diphtheria, 1 case; membranous croup, 1 case; scarlet fever, 12 cases; typhoid fever, 3 cases; whooping cough, 2 cases.

NAVARRE, STARK COUNTY.

John Bailiss, health officer.

Population (estimated), 1,000.

Village in good sanitary condition, and all the laws complied with.

Meetings were held monthly. Expenses \$50. We have no sewerage.

Infectious diseases reported during the year: Scarlet fever, 1 case; typhoid fever 1 case; whooping cough, 3 cases.

NELSONVILLE, ATHENS COUNTY.

C. E. Welch, M. D., health officer.

Population (estimated), 6,500.

The streets, alley-ways, etc., are kept in a sanitary condition. Our main thoroughfares are paved with hard paving block and surface sewage is well provided for. Our sewerage system is excellent as also our city water supply, both being frequently inspected by the proper authorities.

All contagious diseases are promptly reported to me and a record kept of the same. We have no trouble in enforcing restrictive measures. The estimated number of persons vaccinated during the year is 200. Unvaccinated children attending school, probably 800. The board has maintained an active organization during the year and has held regular monthly meetings. Our expense has been \$702.25.

Infectious diseases reported during the year: Diphtheria, 12 cases; mem-

branous croup, 1 case; scarlet fever, 30 cases; typhoid fever; 17 cases; smallpox, 7; whooping cough, 1 case; measles, 36 cases.

tion to all cases. About \$20 spent during year.

Infectious diseases reported during year: Scarlet fever, 4 cases.

NEWARK, LICKING COUNTY.

Dr. Henry Day, health officer.

Population (estimated), 18,147.

The sanitary condition of Newark is fairly good. Streets, alleys and yards are closely watched during spring, summer and fall months.

Sewerage in the well-built-up part of the city is good. Each year the city is putting in more drainage.

Scarlatina, membranous croup and diphtheria are reported; other diseases as typhoid fever are not reported. Can't find out the number vaccinated.

The board has had 3 regular meetings.

Only one case of prosecution; one Henry Beatty in West Newark with 40 hogs. He was arrested 3 times and finally had to get an ordinance passed by City Council, prohibiting any keeping of hogs within so many feet of any residence.

Infectious diseases reported during the year: Smallpox, 2 cases; diphtheria, 15 cases; membranous croup, 4 cases; scarlet fever, 53 cases.

NEWBURG HAMLET, CUYA-HOGA COUNTY.

E. G. Radway, M. D., health officer.

Population (estimated), 6,000.

Sanitary condition, fair. There is no cause for complaint from lack of sewerage. There are no nuisances which the board has been unable to abate. Night soil and garbage is removed by contract.

Contagious diseases are not properly reported, but when reported, a record is kept. Restrictive measures are enforced. Smallpox has been more prevalent than usual. Estimated number of persons vaccinated, 169.

The board held 13 meetings and expended \$2,900. No prosecutions.

Infectious diseases reported during the year: Smallpox, 80 cases; diphtheria, 12 cases; membranous croup, 2 cases; scarlet fever, 3 cases; measles, 2 cases.

NEWCOMERSTOWN, TUSCARAWAS COUNTY.

D. C. Whiting, Jr., health officer.

Population (estimated), 2,700.

Infectious diseases reported during the year: Scarlet fever, 1 case; typhoid fever, 31 cases; measles, 27 cases.

NEW HOLLAND, PICKAWAY COUNTY.

J. Q. Shepherd, health officer.

Population (estimated), 1,000.

The sanitary condition of the village as regards the streets, alleys, etc., is fair. Night soil and garbage is hauled away and dumped out into a sink. Dead animals are buried.

NEW BREMEN, AUGLAIZE COUNTY.

Dr. M. S. Ekermeyer, health officer.

Population (estimated), 1,400.

The sanitary condition is good for so small a village. All nuisances are abated. Night soil is carted out of town on farmers' lands.

Contagious diseases are reported to the health officer and placarded by the sanitary police. No vaccinations.

The board of health held two regular meetings and a number of specials. The work is done by the health officer and sanitary police. We pay strict atten-

The doctors have kept a record of all contagious diseases. Our village has been unusually healthy this year.

There has been no vaccination done at our place. But few of the children have been vaccinated.

The board of health hold their regular meeting once a month. Twenty-five dollars expended.

Infectious diseases reported during the year: Diphtheria, 1 case; membranous croup, 1 case; whooping cough, 6 cases.

NEW CARLISLE, CLARK COUNTY.

Geo. W. Pierce, ex-health officer.

Population (estimated), 995.

The mayor failed to reorganize a board of health last spring, and of course there is really no board at present. There has been no meeting of the board during the last summer, and no health officer appointed.

I think the sanitary condition of the village is good.

NEW LEXINGTON, PERRY COUNTY.

Wm. T. Rambo, health officer.

Population (estimated), 1,800.

Streets, alleys and yards are in a cleanly condition. All nuisances reported were promptly removed. Night soil removed by vault cleaners and taken outside of village.

Contagious diseases reported, but not a complete record kept. Number of school children in attendance 450. Number not vaccinated about 100.

Board held eight meetings during the year. Total expenses, \$75.00. No prosecutions.

Infectious diseases reported during the year: Typhoid fever, 15 cases.

NEW LONDON, HURON COUNTY.

Dr. A. M. Turner, health officer.

Population (estimated), 1,500.

Our village is in good sanitary condition. We have an active board of health. Sewerage not good. We have no trouble to abate nuisances.

All contagious diseases are properly reported and a record kept. There has not been any school children vaccinated during the year.

Board meetings during the year, 18.

Total amount spent during the year, \$138.19.

Infectious diseases reported during the year: Diphtheria, 2 cases; scarlet fever, 3 cases; typhoid fever, 4 cases; measles, 1 case; other infectious diseases, 3 cases.

NEW MATAMORAS, WASHINGTON COUNTY.

Adam S. Miracle, health officer.

Population (estimated), 800.

Our board has been active during the year. Streets, alleys and yards are kept clean. The town is well drained and kept in good shape. There are no nuisances but what have been removed by order of board. No arrangements for removal of night soil. Garbage carted off or burned.

Contagious diseases are all reported, to the best of my knowledge, and record kept. The most prevalent disease was scarlet fever. I believe all children of school age have been vaccinated. There has been but little expense, except for disinfectants. No prosecutions.

I think our board has done all it could in its duties the past year.

Our doctors have been very successful in their duties and have not lost a case the past year. There is but one case in the town at present—that is scarlet fever. It is light, as all cases have been.

Infectious diseases reported during the year: Diphtheria, 3 cases; scarlet fever, 21 cases; typhoid fever, 5 cases; whooping cough, 57 cases; measles, 10 cases.

NEW PARIS, PREBLE COUNTY.

J. Harvey Guthrie, M. D., health officer.

Population (estimated), 900.

The sanitary condition of the town is good, thanks to nature, which has been kind to the town.

Contagious diseases have not been properly reported in the past, as the present health board has only been organized since last August. An effort is being made to have the work systematized and records kept. The only contagious diseases we have had to deal with are scarlet fever and varicella.

The health board has held four meetings during the year. No prosecutions have been brought by the board.

Infectious diseases reported during the year: Scarlet fever, 12 cases; typhoid fever, 5 cases; whooping cough, 1 case; measles, 1 case.

NEW PHILADELPHIA, TUSCARAWAS COUNTY.

Geo. H. Peck, M. D., health officer.

Population (estimated), 6,500.

The streets, alleys and yards are in a cleanly condition. There is not sufficient sewerage. The night soil is removed as authorized by the board of health and garbage is deposited on land chosen for that purpose.

Contagious diseases are properly reported and record of such diseases kept. Scarlet fever and measles have been the most prevalent of contagious diseases. The number of unvaccinated children attending public schools (estimated), 300.

Number of meetings held by the board of health during the year, seven. Total amount spent by board of health, \$231.16.

Infectious diseases reported during the year: Diphtheria, 4 cases; membranous croup, 1 case; scarlet fever, 13 cases; typhoid fever, 7 cases; measles, 10 cases.

NEW RICHMOND, CLERMONT COUNTY.

Dr. J. A. Windsor, health officer.

Population (estimated), 2,000.

Streets, alleys and yards in good condition. No complaint on account of sewerage. Have had some trouble with hog pens but now have them under control. Night soil is removed to country.

Contagious diseases are properly reported and a record kept. Have no trouble in enforcing quarantine measures. Have had no contagious diseases in 1900. No vaccinations. We have no children attending schools unvaccinated.

Board had 8 meetings. Spent in 1900 \$91.00. No prosecutions.

Infectious diseases reported during the year: Typhoid fever, 2 cases.

NEW RIEGEL, SENECA COUNTY.

Anthony Imber, health officer.

Population (estimated), 300.

The council acts as the board of health in this village. Council meets twice in a month, and if there is any complaint or any matter referring to this board the same is referred to council at said meetings.

Total expenditures, \$10.00.

Infectious diseases reported during the year: Scarlet fever, 3 cases; typhoid fever, 1 case.

NEW STRAITSVILLE, PERRY COUNTY.

Thomas Taylor, health officer.

Population (estimated), 2,400.

Streets and alleys in this village are in pretty good shape, but could be a great deal better. We have no arrangements for the removal of night soil, except some one comes around for that purpose.

Contagious diseases at all times are not properly reported, so no complete record can be kept. There are 446 unvaccinated children attending school.

The board of health has not kept up a regular organization through the year. At the time we had the smallpox scare, the board held a few meetings for the purpose of having the affected districts quarantined. I think there were six meetings at that time, but the board has not met since.

Infectious diseases reported during the year: Diphtheria, 4 cases; membranous croup, 2 cases; scarlet fever, 7 cases; typhoid fever, 1 case; measles, 3 cases.

NEW WASHINGTON, CRAWFORD COUNTY.

B. R. Miller, M. D., health officer.
Population (estimated), 1,000.

Board of health was re-organized in September, 1900. Report covers last three months of the year.

Streets are kept clean but alleys could be kept in more cleanly condition. Complaint from an improper discharge of sewage in two places. Nothing done yet. No arrangements for removal of night soil and garbage.

All contagious diseases are properly reported. Records are kept. Typhoid fever more prevalent than usual. Number unvaccinated children in public school, 109.

Board of health held two meetings.

Infectious diseases reported during the year: Typhoid fever, 3 cases.

NORTH AMHERST, LORAIN, COUNTY.

Dr. N. H. Cornnell, health officer.
Population (estimated), 1,800.

The city is in a very cleanly condition. The sewerage is bad, not sufficient for the city.

Contagious diseases are promptly reported and a record kept.

We have had no epidemics. Have had three meetings within the last year. Had no prosecutions.

Infectious diseases reported during the year: Smallpox, 1 case; diphtheria,

8 cases; scarlet fever, 10 cases; typhoid fever, 1 case.

NORTH BALTIMORE, WOOD COUNTY.

Dr. J. W. Stoner, health officer.
Population (estimated), 3,600.

Streets, alleys and yards mostly clean. The only complaint in regard to sewerage is the outlet of Water street sewer which opens into the abandoned creek channel at the side of the street. Night soil and offensive garbage is hauled to the country and buried.

Diphtheria, scarlet fever and measles are reported, other contagious diseases not. Typhoid fever was unusually prevalent. Very few vaccinations during the year and a very large percentage of our school children are unvaccinated.

The board held twelve meetings last year and expended about \$210. No prosecutions were necessary.

Infectious diseases reported during the year: Diphtheria, 3 cases; measles, 2 cases.

NORTH LEWISBURG, CHAMPAIGN COUNTY.

A. Spain, health officer.
Population (estimated), 1,050.

Streets and alleys are in fair condition. We have no sewerage. There are no nuisances which the board has tried to abate and failed. Each person is required to dispose of their own garbage.

Contagious diseases are properly reported with a few exceptions. A record is kept of contagious diseases.

The board has been able to enforce proper restrictive measures. There have been no contagious diseases more prevalent than usual. No persons vaccinated during the year. Number of unvaccinated children attending school, about 125. The board has held two meetings during the year. The board

has spent \$18.45 during year. The board has brought no prosecutions.

Infectious diseases reported during the year: Scarlet fever, 1 case; typhoid fever, 3 cases.

NORTH ROBINSON, CRAWFORD COUNTY.

J. J. Robertson, health officer.

Population (estimated), 250.

Sanitary condition of the village is good. Sewerage good. We have but little trouble to abate nuisances. Night soil as a rule is buried.

Contagious diseases are reported and a record kept. None vaccinated during the year. Possibly one-third of school children not vaccinated.

We try to meet once a month, some months twice. No prosecutions brought by the board to enforce health laws.

Infectious diseases reported during the year: Typhoid fever, 1 case; measles, 11 cases.

NORWALK, HURON COUNTY.

Dr. Edgar Martin, health officer.

Population (estimated), 7,500.

Sanitary condition is good. Board has maintained an active working system and been very successful in preventing disease. Streets and alleys clean. No cause for complaints as to lack of sewerage. Night soil removed in barrels outside city limits.

Contagious diseases properly reported. Record kept. The board has been able to enforce proper restrictive measures. No contagious diseases have been prevalent to any extent. Board of health met every two weeks. Amount spent about \$300 per year. No prosecutions.

Infectious diseases reported during the year: Diphtheria, 10 cases; membranous croup, 3 cases; scarlet fever, 7 cases; typhoid fever, 6 cases; measles, 30 cases.

NORWOOD, HAMILTON COUNTY.

Dr. J. C. Cadwallader, health officer.
Population (estimated), 7,000.

The sanitary condition of the village is good, as demonstrated in the report. The board has maintained an active interest in all measures pertaining to the health of the village, indorsing the action of its health officer in every particular. The sewerage system has been completed throughout the village and an excellent water supply from driven wells affords good flushing.

Contagious diseases are properly reported and there has been no epidemic. Vaccination has been enforced in the public schools.

Infectious diseases reported during the year: Smallpox, 1 case; diphtheria, 10 cases; membranous croup, 5 cases; scarlet fever, 5 cases; typhoid fever, 5 cases; whooping cough, 6 cases; measles, 12 cases.

OAK HARBOR, OTTAWA COUNTY.

Dr. F. S. Heller, health officer.

Population (estimated), 2,000.

No contagious diseases.

OAKLEY, HAMILTON COUNTY.

E. C. Wamacks, health officer.

Population (estimated), 600.

Our village is in a perfect sanitary condition. We have no sewers; population is sparse.

Contagious diseases are properly reported and record of such diseases is kept.

We have only had two meetings during the year. We have had no prosecutions. We have adopted resolutions in regard to the depth of vaults, also to the cleaning of same. No arrangements have been made for disposition of night soil.

Infectious diseases reported during the year: Scarlet fever, 2 cases.

OBERLIN, LORAIN COUNTY.

W. L. Biggs, health officer.

Population (estimated), 4,800.

The work of the board of health during the past year has moved off quietly with nothing to disturb its serenity. There have been about 10 meetings held during the year, and everything has been done as desired. The board has expended about \$14.38, but the health officer is a general factotum and his salary covers all his duties.

In all cases of scarlet fever, measles and diphtheria the houses have been very carefully fumigated with formaldehyde, and no instance has been found where the fumigation was not effectual in killing the disease germs.

Infectious diseases reported during the year: Diphtheria, 5 cases; scarlet fever, 36 cases; typhoid fever, 9 cases; measles, 33 cases.

ORRVILLE, WAYNE COUNTY.

Dr. A. A. Brooks, health officer.

Population (estimated), 2,000.

Our streets and alleys are in good sanitary condition. We have very little sewerage. The board has successfully abated nuisances. No arrangement has been made for disposal of garbage and night soil.

Physicians are prompt in reporting contagious diseases. The board has enforced proper restrictive measures. Diphtheria has been the most prevalent contagious disease. There has been very little or no vaccination in last year. There are 429 pupils enrolled in our public schools, of this number 142 have not been vaccinated.

The board has had five regular meetings in last year. About two hundred dollars has been spent by board in last year. Undertaker arrested for burying without permit. Plead guilty and was fined one dollar and costs.

Infectious diseases reported during the year: Diphtheria, 51 cases; scarlet fever, 18 cases; typhoid fever, 5 cases.

OSGOOD, DARKE COUNTY.

A. R. Lupinger, health officer.

Population (estimated), 350.

No contagious diseases.

OSTRANDER, DELAWARE COUNTY.

A. J. Pounds, M. D., health officer.

Population (estimated), 500.

The board has maintained an active organization, and has been partly successful in enforcing proper measures for the prevention of contagious diseases.

Streets, alleys and yards were put in good condition. There is cause for complaint from the lack of drainage. The arrangements for removal of garbage and night soil are good.

Contagious diseases are not properly reported. The most prevalent disease has been typhoid fever. Number of persons vaccinated during the year, about 50.

We have held regular meetings during the warm months. Amount expended during the year, about \$35.00.

Infectious diseases reported during the year: Typhoid fever, 16 cases; measles, 2 cases; other infectious diseases, 5 cases.

OTTAWA, PUTNAM COUNTY.

E. L. Tupper, health officer.

Population (estimated), 2,200.

Streets and alleys in good condition. We have sewers opening into a low land near the river, which in the hot months of summer sometimes cause some complaint, but since I have been health officer nothing unpleasant has arisen. Night soil is removed to a lot three miles from town and there buried.

Contagious diseases are properly reported and a record kept. Proper precautions taken. Scarlet fever, diphtheria, chicken pox and measles have been more prevalent than usual. Number of children in public schools 400 — 105 not vaccinated. Number of pupils in paro-

chial schools — not been able to get a report — have sent three requests. Majority vaccinated.

Meetings of board of health held once a month in warm weather, once every two months during winter. Amount spent about \$100.00. No prosecutions.

Infectious diseases reported during the year: Diphtheria, 10 cases; membranous croup, 3 cases; scarlet fever, 5 cases; measles, 3 cases; other infectious diseases, 2 cases.

OXFORD, BUTLER COUNTY.

W. E. Calohan, health officer.

Population (estimated), 2,009.

The streets and alleys are in good condition. We have no sewerage. We have no nuisances in the village. Night soil is carted away in tight barrels. Garbage is hauled off twice a week.

All contagious diseases are reported. The superintendent of schools says it is impossible to say how many unvaccinated children there are, but they make special effort to have it done every year.

The board has expended about \$109.

Infectious diseases reported during the year: Scarlet fever, 9 cases.

PAINESVILLE, LAKE COUNTY.

Dr. E. D. Whitney, health officer.

Population (estimated), 5,000.

Streets, alleys and yards are in a cleanly condition. The sewerage is well handled. Night soil and garbage are taken to a public dumping grounds outside of the corporation line. Nuisances are under good control.

The physicians have reported well everything except chickenpox and whooping cough. Typhoid was more prevalent than usual last winter. This fall there has been reported about the usual number of cases. Not over 100 persons have been vaccinated during year. Probably about one-half of the school children are unvaccinated.

Ten meetings of the board have been held. No prosecutions have been conducted during the year.

Expenses of the board of health: health officer and clerk, salaries of, \$150; sanitary inspector, salary, of \$75; dumping grounds, rent of, \$50; printing, \$1.50; incidentals, \$2.50. Total, \$279.

S. A. Haskell has served the board as clerk. S. R. House has served the board as sanitary inspector.

Infectious diseases reported during the year: Smallpox, 1 case; diphtheria, 1 case; scarlet fever, 2 cases; typhoid fever, 26 cases; whooping cough, 10 cases; measles, 5 cases.

PATTERSON, HARDIN COUNTY.

P. C. Breidenbach, health officer.

Population (estimated), 250.

Sanitary condition of village good. Citizens have willingly complied with every reasonable request to clean alleys, etc.

There have been no contagious diseases in the village during year 1900. None have been vaccinated during the past year.

The board of health held four meetings during the last year and spent \$17.

No prosecutions have been brought by the board of health.

PAULDING, PAULDING COUNTY.

John H. Hosford, M. D., health officer.

Population (estimated), 2,500.

Streets and alleys are in a clean condition and there is no cause for complaint on account of sewerage. The town has a good dump grounds and night soil is attended to by the scavengers.

Contagious diseases are promptly reported to me. The board has been able to enforce all its orders and laws without any trouble. Can't give exact

number vaccinated, but the children going to school were all vaccinated last winter in March. I think there are very few in town who are unvaccinated.

Board of health has held 21 meetings and spent by board \$151.34. One prosecution for violation of orders of the board of health. Party was fined \$100 and costs.

Infectious diseases reported during the year: Diphtheria, 4 cases; scarlet fever, 3 cases; typhoid fever, 6 cases.

PAYNE, PAULDING COUNTY.

Dr. J. E. Mulligan, health officer.

Population (estimated), 1,500.

Infectious diseases reported during the year: Smallpox, 65 cases; diphtheria, 2 cases; scarlet fever, 2 cases; typhoid fever, 15 cases; whooping cough, 50 cases.

PEEBLES, ADAMS COUNTY.

O. W. Robe, M. D., health officer.

Population (estimated), 1,000.

Streets, alleys and yards have been kept in a cleanly condition for the past year. Yet the sewerage is very bad. Our drains are all surface, and not deep enough, even on our main street, to carry off water during a heavy rain. Garbage is kept in barrels and then removed.

Our contagious diseases are not properly reported, yet when reported a record is kept of same.

Smallpox has been our most prevalent disease. I would estimate 300 persons were vaccinated during the year, and one-third of school children not vaccinated.

The board of health had ten meetings during the year. Total amount spent by board \$93.45. No prosecutions.

Infectious diseases reported during the year: Smallpox, 13 cases; typhoid fever, 3 cases.

PEMBERVILLE, WOOD COUNTY.

Henry E. Long, health officer.

Population (estimated), 1,400.

All garbage, dead rats and cats are thrown into the alleys. Sewerage is good. We have a dumping ground for night soil.

Contagious diseases are not reported and there is no record of contagious diseases kept. The board has not tried to enforce any measures. Typhoid fever and measles have been most prevalent. I do not know of any vaccinations. There are about 350 unvaccinated children attending school.

Board of health has not had a meeting for three years. There was a new board appointed two years ago in April and they were never sworn in. It will be three years in April since there has been a meeting and I have not had a cent for my work. Since we elected a new mayor this spring we hope for better times.

Infectious diseases reported during the year: Scarlet fever, 2 cases; typhoid fever, 10 cases; measles, 30 cases.

PIKETON, PIKE COUNTY.

Samuel M. Kellison, health officer.

Population (estimated), 700.

Infectious diseases reported during the year: Typhoid fever, 1 case.

PIONEER, WILLIAMS COUNTY.

S. P. Waters, health officer.

Population (estimated), 800.

Sanitary condition of village is good. Board has been as active as necessary and has been successful in enforcing proper measures for the prevention of contagious diseases and abatement of nuisances. Streets and yards are generally in a cleanly condition. No complaint on account of sewerage. There are no nuisances which the board has been unsuccessful in abating. Night soil and garbage are hauled away.

Contagious diseases are properly reported but no record is kept. The board has been able to enforce proper restrictive measures. Whooping cough has been the most prevalent disease.

No vaccination during the year. Out of 142 pupils, 42 are vaccinated.

Four meetings have been held by the board. No expenditures by the board during the year and no prosecutions for violations of its orders or health laws.

Infectious diseases reported during the year: Whooping cough, 7 cases; other infectious diseases, 1 case.

PIQUA, MIAMI COUNTY.

Dr. F. E. Kitzmiller, health officer.

Population (estimated), 12,000.

The city streets, alleys and yards are in fairly good sanitary condition. Sewerage good and in good condition. All nuisances are promptly abated and night soil is hauled out upon farms and plowed under.

Contagious diseases are generally reported promptly and are carefully quarantined. Scarlet fever has been most prevalent, although mild in character. Scarcely any persons have been vaccinated during the year. Large majority of school children are unprotected by vaccination.

Board of health meets monthly except once in a while we have no quorum. No prosecutions.

Infectious diseases reported during the year: Diphtheria, 4 cases.

PLAIN CITY, MADISON COUNTY.

Dr. E. S. Holmes, health officer.

Population (estimated), 1,800.

The board of health of this village has maintained an active organization. During the year they had twelve meetings and have expended about three hundred and fifty dollars. Owing to the prevalence of smallpox at the beginning of the year, all school children were vac-

inated and smallpox was the most prevalent disease.

The village is in a fairly good sanitary condition. Streets, alleys and yards are clean. Night soil and garbage are removed by scavenger to a farm about one mile from village. There is no sewerage system.

Contagious diseases are reported, excepting typhoid fever, whooping cough and measles. Impossible to estimate number of vaccinations and board was successful in restricting smallpox.

Infectious diseases reported during the year: Smallpox, 12 cases; membranous croup, 1 case; scarlet fever, 1 case.

PLEASANT HILL, MIAMI COUNTY.

A. S. Bausman, health officer.

Population (estimated), 500.

Town in good sanitary condition.

Contagious diseases have been quarantined.

Board of health has held three or four meetings during the year.

Infectious diseases reported during the year: Typhoid fever, 4 cases.

PLEASANT RIDGE, HAMILTON COUNTY.

C. W. Acomb, health officer.

Population (estimated), 1,250.

Sanitary condition good. Improved streets regularly cleaned and all refuse hauled away. Other streets and byways are in a fair condition.

Have maintained an active organization and enforced rules to prevent contagion and abate nuisances.

We have not as yet any sewerage system. Only complaints we have had to adjust have been from 4 to 12 inch pipes that empty on adjoining property. Night soil removed in tight wagon outside of village on farms and away from streams. Garbage is disposed of by property owner.

Contagious diseases, we believe, are properly reported and a record of same is kept. We enforce restrictive measures.

The meeting place of the board of health is lighted and ready for business the last Saturday evening of each month, but we have had but two regular sessions. The clerk and health officer are required to be present at each monthly meeting and if there is any business to be transacted members of board are notified.

One hundred and twenty-five dollars is allowed for sanitary purposes.

Infectious diseases reported during the year: Diphtheria, 1 case; scarlet fever, 3 cases.

PLEASANTVILLE, FAIRFIELD COUNTY.

Dr. W. E. Baker, health officer.

Population (estimated), 750.

Our board has been inactive during the year, with few meetings. No prosecutions. Sanitary condition moderate. Need drainage. Streets and alleys in fair condition. No arrangement for removal of night soil and garbage. Amount expended about \$20.00.

Have had no contagious diseases during year. Reports are allright. Unable to give number of children vaccinated and not vaccinated. Reorganization of board January 1, 1901.

POLK, ASHLAND COUNTY.

Dr. W. H. Reinhart, health officer.

Population (estimated), 232.

Don't know if I am health officer or not. Board has not held session for nearly two years. Is not expending any money; not even in payment of health officer's salary (\$5.00 per year). Board is in a state of "inocuous dissuétude." Sanitary condition of village is quite good. No complaints being made. Number of unvaccinated children in schools about 50.

No meetings of board. No prosecutions. No deaths in corporation past year. A half dozen cases of scarlatina occurred—very light form.

Infectious diseases reported during the year: Scarlet fever, 6 cases.

PORTAGE, WOOD COUNTY.

Pheonus Fasnaugh, health officer.

Population (estimated), 700.

The health of the village has been good. The sanitary condition is fairly good. We have a regular organization. So far we have had no contagious diseases to any extent. There are some nuisances that need looking after more thoroughly. For removing night soil we have a contract; also rent dump ground.

Expenses about \$50 a year.

Infectious diseases reported during the year: Typhoid fever 2 cases.

PORTSMOUTH, SCIOTO COUNTY.

Dr. L. A. Vernier, health officer.

Population (estimated), 18,000.

The city in general is in fair sanitary condition. The sewerage is good. The city council has charge of the removal of garbage and we have considerable complaint as to the way it is done.

We have been having some difficulty in getting the physicians to report promptly cases of contagious diseases. I filed complaint in the mayor's court against three local physicians for violation of Section 2118, Revised Statutes of Ohio, and the cases were dismissed for lack of sufficient evidence, but since then physicians have been more prompt in reporting. Smallpox has been more prevalent here than usual, having had eighteen cases during the year; every case of which, with one or two exceptions, has been brought into the city from Kentucky.

During the year the board has met sixteen times and the bills approved (and paid by the city clerk) amounted

to \$1,992.74, which includes salaries of officers \$950.00, also for taking care of smallpox cases about \$700.00.

Infectious diseases reported during the year: Smallpox, 18 cases; diphtheria, 17 cases; membranous croup, 1 case; scarlet fever, 10 cases; typhoid fever (estimated) 50 cases; whooping cough (estimated), 500 cases; measles (estimated), 500 cases.

PORT WASHINGTON, TUSCARAWAS COUNTY.

M. W. Nargney, health officer.

Population (estimated), 600.

Streets, alleys and yards are in a cleanly condition. There is no cause for complaint on account of sewerage. There are no nuisances which the board has unsuccessfully tried to abate.

Contagious diseases are not properly reported but a record is kept of those that are. The board has not in all cases been able to enforce restrictive measures. Four is the estimated number of persons vaccinated during the year. Number of unvaccinated school children 105.

The board held three meetings and expended \$12.50. No prosecutions.

Infectious diseases reported during the year: Diphtheria, 2 cases; typhoid fever, 4 cases; whooping cough, 23 cases; other infectious diseases, 4 cases.

PORT WILLIAM, CLINTON COUNTY.

S. L. Thorp, health officer.

Population (estimated), 300.

We have no organized board of health but need something of the kind very much.

Infectious diseases reported during the year: Typhoid fever, 2 cases; measles, 1 case.

PROSPECT, MARION COUNTY.

G. F. Gast, health officer.

Population (estimated), 1,100.

Infectious diseases reported during the year: Diphtheria, 1 case; typhoid fever, 3 cases; measles, 1 case; other infectious diseases, 2 cases.

PUT-IN-BAY, OTTAWA COUNTY.

Adam Heidle, health officer.

Population (estimated), 300.

Streets are clean. There was cause for complaint last summer from improper discharge of sewage. Better sewerage discharge is promised for 1901. The sewerage was bettered last August, when prosecution was about to be begun.

Contagious diseases are properly reported and record kept. This village had none last year (1900); not one case. Many children in the public schools are vaccinated.

The board had two meetings in 1900. Expenditure, in money, nothing. No prosecutions for violations.

QUINCY, LOGAN COUNTY.

G. B. Plummer, health officer.

Population (estimated), 750.

The board of health has been enforcing proper measures for the prevention of contagious diseases and the abatement of nuisances. The sanitary condition is very poor as the side ditches are in very poor condition, and the drainage is not very good, but they are making efforts to make them better. The regulations have been enforced and the night soil has been removed.

Contagious diseases are properly reported and a record of the diseases has been properly kept. The board has been able to enforce proper restrictive measures so far. Chickenpox and scarlet fever have been more prevalent than usual. There have not been any persons vaccinated during the year. Ten scholars out of 140 have been vaccinated in our schools.

This last board of health was organized in September, and have held a meeting every fourth Monday in each month since its organization. Amount paid out by board of health during the year, \$52.75.. There has not been any violations of the health laws or its orders.

Infectious diseases reported during the year: Diphtheria, 1 case; scarlet fever, 1 case; whooping cough, 10 cases; other infectious diseases, chickenpox, 5 cases.

RAVENNA, PORTAGE COUNTY.

Lee W. Wood, health officer.

Population (estimated), 4,500.

I have the honor of submitting the following report as to the operations of this board, and to the sanitary condition of the city. This board has maintained an active organization, and the town is in as good sanitary condition as possible, without a system of sanitary sewerage, which we need above all things. With this one exception we have a model little city; but with a good many open ditches and incomplete storm sewers, the condition of things is not all that could be desired. The removal of night soil is in sealed casks.

Contagious diseases are not reported as promptly as they ought to be. There has been no record kept. Measles has been more prevalent than usual.

The board meets every month. Have spent about \$450 during the year.

RAWSON, HANCOCK COUNTY.

J. J. Hawk, health officer.

Population (estimated), 473.

Streets, alleys and yards are in a cleanly condition. There is complaint from the lack of sewerage. There are no nuisances but which the board of health has successfully abated. The town has purchased two garbage barrels for the purpose of removing night soil outside corporate limits.

Contagious diseases are properly reported by doctors. There has been no record kept of such. Board has been able to enforce restrictive measures, such as quarantine, etc. Measles has been more prevalent than any other contagious disease. The number vaccinated during the past year could not be ascertained, but likely about 15 have been vaccinated out of the village population.

Board of health had twelve meetings during the year 1900. Board of health ordered paid the amount of \$9.70 for incidentals. One violation for breaking quarantine of diphtheria. The case is in common pleas courts at present.

Infectious diseases reported during the year: Diphtheria, 1 case; typhoid fever, 3 cases; whooping cough, 35 cases; measles, 40 cases.

READING, HAMILTON COUNTY.

Riley Murphy, health officer.

Population (estimated), 4,000.

The streets, alleys and yards of this village are kept in fairly clean condition. There is no system of sewerage, except surface drainage to the creek. No particular trouble has been experienced in abating nuisances. Night soil is removed under the supervision of the health officer to a point beyond the corporate limits of the village.

Contagious diseases are generally reported and a record is kept of such cases. Have found no trouble in enforcing the proper restrictive measures. Diphtheria has been the prevailing disease in this locality, fifty cases have been reported at this office, with one death. The disease has been of a mild form, and when treated with antitoxine, only lasting three or four days. Estimated number of persons vaccinated during the year, 50. About 60 per cent. of the children attending school are unvaccinated.

In September of 1900, a circular was issued by this board, and distributed throughout the village, advising people to have their children vaccinated.

The board meets regularly once every month. Expenses of the board for the year:

Salary of health officer.....	\$100 00
Salary of clerk	50 00
Salary of assistant sanitary officer	5 25
Printing	6 50
Postage	1 00
	<hr/>
	\$162 75

Additional expenses for maintaining quarantine on account of diphtheria\$105 75

Total\$268 50

Infectious diseases reported during the year: Diphtheria, 50 cases; membranous croup, 6 cases; typhoid fever, 7 cases; whooping cough, 3 cases; measles, 4 cases.

REPUBLIC, SENECA COUNTY.

F. C. Gilcher, M. D., health officer.
Population (estimated), 650.

The streets, alleys and yards are kept in a clean and sanitary condition.

Contagious diseases are, as a rule, promptly reported. We find it rather hard to educate the people to report mild cases of contagious diseases (measles, whooping cough, etc.), where no physician is called. A record of contagious diseases is kept. We have been very free from all contagious diseases, with the exception of measles, and there were only fourteen cases reported during the year and no deaths.

The board of health meets on the first Thursday of every month. The total amount spent by the board of health during the year was \$33.00. There were no prosecutions brought by the board of health during the year.

Infectious diseases reported during the year: Measles, 14 cases.

REYNOLDSBURG, FRANKLIN COUNTY.

Dr. L. A. Parkinson, health officer.
Population (estimated), 400.

Streets, alleys and yards are now in good sanitary condition. There is now no cause for complaint in regard to sewerage and sewage. There are no nuisances which the board has unsuccessfully tried to abate. Ashes are disposed of by being used to fill depressions in walks, upon streets, etc. Kitchen refuse is either fed to swine or poultry, or thrown upon manure heaps, and hauled away by the farmers, as part thereof. In regard to night soil, it is mostly mixed with dry dirt, and buried upon garden lots.

In regard to contagious diseases, there has been no epidemic of any sort prevailing in this village during the year, save one or two families of children who had measles during winter of 1900. So there has been no trouble at all in regard to contagious or infectious diseases in this village recently. Vaccination is agitated from time to time, when smallpox appears in the city, but I do not think there have been any vaccinations done here during the year. As to the number of unvaccinated pupils in public schools here, I can not speak definitely, but feel assured there are but few, probably some amongst the primary pupils.

The regular monthly meetings of the board have not been held; but council, at the instigation of Mayor Lindsay, appointed a full membership so that in case legal steps become necessary in any event, we could make our proceedings and actions accordingly. Ordinarily the mayor and I would confer together about any unsanitary conditions which were observed to prevail from time to time, then if the matter seemed to constitute a nuisance, we would serve the proper party with a written notice to abate same, and it was always done. Thus far, the board have served nine written notices to abate nuisances, during the past summer, and the nuisances were abated. There have been no fines or prosecutions, hence no expense save registry fee where it was necessary to send notice by registered mail, also postage.

RICHWOOD, UNION COUNTY.

George W. Morgan, health officer.

Population (estimated), 1,750.

There are 224 unvaccinated children attending public school.

Total amount spent by board of health, \$73.12.

RIDGEWAY, HARDIN COUNTY.

Dr. E. B. Craw, health officer.

Population (estimated), 500.

Our streets, alleys and yards are kept in good condition. Our sewerage is good. We have no unabated nuisances. Garbage is removed by street commissioner.

Contagious diseases are promptly and well reported. Not more than 25 per cent. of the school children present evidence of successful vaccination.

There have been no prosecutions for violations of health laws during the past year. Board of health has expended nothing, as when nuisances occur we simply notify marshal or street commissioner and same are removed at expense of property owners or corporation.

Scarlet fever and measles are the only contagious diseases we have had during the past year and no deaths from either.

Infectious diseases reported during the year: Scarlet fever, 14 cases; measles, 6 cases.

RIPLEY, BROWN COUNTY.

G. M. Robb, health officer.

Population (estimated), 2,500.

The sanitary condition is good.

All contagious diseases are properly reported. The board has been able to enforce all of its rules and regulations. We have had 8 meetings during the year.

The health of our village is good at present. Money expended, \$12.

Infectious diseases reported during the year: Typhoid fever, 12 cases.

RISINGSUN, WOOD COUNTY.

George W. Ragon, health officer.

Population (estimated), 1,000.

Streets, alleys and yards are very clean. Sewerage is good. No nuisances. Night soil and garbage must be hauled 2 miles from town.

Contagious diseases are now reported. About one-fourth of the school children are not vaccinated.

The board met four times. About \$70 was expended.

Infectious diseases reported during the year: Typhoid fever, 9 cases.

ROCHESTER, LORAIN COUNTY.

J. C. Dignan, health officer.

Population (estimated), 300.

The sanitary condition of our village has never been surpassed during my career as health officer which was inaugurated June '97. The board has maintained an active organization throughout the year.

Contagious diseases have been reported and restrictive measures instituted. Streets and alleys are in a cleanly condition. The discharge of sewage, while not first-class is in a condition free from warranting complaint.

We have been entirely successful in abating all nuisances, therefore, there have been no prosecutions for refusal. Removal of night soil and garbage is attended to by property holders.

Measles and typhoid have been most prevalent of contagious diseases. I have not been able to secure the number of unvaccinated children, but as a very limited number have been vaccinated, I venture to say that the majority can be listed as unvaccinated.

The expenses for the past year have been about \$10.

ROCKPORT, CUYAHOGA COUNTY.

W. L. Nichols, clerk of board of health.

Population (estimated), 2,238.

All streets and alleys are in cleanly and sanitary condition. There has been no complaint from lack of sewerage. There is no nuisance which the board has not been successful in abating. Each property holder takes care of his own night soil and garbage.

Contagious diseases are fairly well reported. A record of such diseases is now kept. The board has been able to enforce proper restrictive measures. Am not able to give an estimate as to number of persons vaccinated, as no record is kept.

Board of health now meets the last Monday of each month at regular meetings. Total amount expended by board of health during the year, \$390.04.

Infectious diseases reported during the year: Smallpox, 3 cases; diphtheria, 1 case; scarlet fever, 3 cases; measles, 1 case.

RUSHLYLVANIA, LOGAN COUNTY.

Dr. J. G. Sutton, health officer.

Population (estimated) 575.

Our board of health is always ready to act and does when health is at stake, but during last year the board did not meet often, probably only three of four times. Condition of streets, good; alleys, fair. Night-soil removed from town once or twice a year. The town uses mostly cistern water. We have no typhoid fever which can be traced to bad sanitary conditions here. I do not know the exact number, but can say that we have had less than six cases in the eight years last past.

Contagious diseases are properly reported to the health officer, but he has failed to report to the State Board as he should have done. I am the guilty one for about three years. The board has no trouble to enforce proper re-

strictions in contagious diseases. For two years last past we have had quite a number of scarlet fever cases—mild mostly—no deaths. Probably about 15 or 20 have been vaccinated during the year. All school children and many others in town and township were vaccinated about six years ago.

We have neglected to keep a record of deaths, births and diseases.

I can assure you that we are very careful to stamp out contagious diseases promptly, and also careful not to allow the diseases of said character to spread to other places from any neglect of our own.

RUSHVILLE, FAIRFIELD COUNTY.

Dr. Willis G. Lewis, health officer.

Population (estimated) 300.

The sanitary condition of village is good. All nuisances reported have been abated. We have no sewerage. Vaults are used for night-soil.

We have had no contagious diseases. Vaccination has not been performed in any case. A large majority of pupils have never been vaccinated.

There have been two meetings only of the board of health.

About \$20.00 was expended.

ST. BERNARD, HAMILTON COUNTY.

Henry J. Nailer, health officer.

Population (estimated) 3,400.

Streets and alleys clean. We have no sewerage to amount to anything. Night-soil is carted out of village.

Contagious diseases are reported properly and a record kept. Number of children not vaccinated in public and parochial schools, about 400.

Board of health meets regularly on third Wednesday of every month. We had two plumbers arrested for doing work without applying to the board for permit to do so.

Infectious diseases, reported during the year: Diphtheria, 4 cases; membranous croup, 4 cases; scarlet fever, 4 cases; typhoid fever, 1 case; whooping cough, 1 case; measles, 1 case.

ST. MARY'S AUGLAIZE COUNTY.

B. E. Thomas, M. D., health officer.
Population (estimated) 6,000.

Streets and alleys are kept in a cleanly condition. We are still badly in need of a sewerage system. Night-soil and garbage is carted without the village limits.

All contagious diseases are promptly reported and the rules of the State Board of Health strictly enforced. We have had a number of cases of scarlet fever. Most cases have been mild—so mild, in fact, that the diagnosis was often questioned. On account of having had smallpox here three years ago the majority of school children have been vaccinated.

Board of health has had six meetings during the past year. We have had no trouble in enforcing the rules of the State and local board. \$250.00 has been spent by the local board.

Infectious diseases reported during the year: Diphtheria, 10 cases; membranous croup, 1 case; scarlet fever, 40 cases; typhoid fever, 10 cases.

SALEM, COLUMBIANA COUNTY.

A. C. Yengling, M. D., health officer.
Population (estimated) 7,582.

Streets nearly all paved. Alleys fair. Water very good all year from deep wells. Sewerage not good—outlet in small spring run. We need crematory and better sewers and more of them, yet a number of streets have been sewered in the past two or three years. Night-soil is removed in air-tight barrels at night and hauled to the country.

Contagious diseases are regularly re-

ported. Records of all cases of contagious diseases, all deaths and births are strictly kept and recorded in the books for that purpose. I called upon each school in the city and counted all children successfully vaccinated. There were 387 out of an enrollment of 1,930 in lower grades; not more than 5 per cent. in third and fourth grades; 10 per cent. in fifth to eighth, and high school 12 per cent.

Board of health meets regularly twice a month. No prosecutions last year.

Expended, \$1061.55.

Infectious diseases reported during the year: Diphtheria, 30 cases; membranous croup, 3 cases; scarlet fever, 8 cases; typhoid fever, 19 cases; measles, 3 cases; whooping cough, 61 cases.

SALESVILLE, GUERNSEY COUNTY.

W. E. McKinley, health officer.
Population (estimated) 400.

Sanitary condition fairly good. Streets, yards and alleys in fair condition. The board has been somewhat dilatory, not having met during the last twelve months, but there is little cause for complaint, as health has been good, with but two deaths and both from local diseases.

Contagious diseases have all been reported to health officer, but no record kept. There have been no vaccinations.

Infectious diseases reported during the year: Typhoid fever, 1 case; whooping cough, 25 cases; mumps, 5 cases.

SALINEVILLE, COLUMBIANA COUNTY.

James Carter, health officer.
Population (estimated), 2,300.

Streets and alleys are in good condition considering the deficiency of sewerage. Have no trouble in abating nuisances. No arrangement made as yet for the removal of night soil and garbage. When the vaults get foul we insist on new ones being made.

Contagious diseases are reported and a record kept of the same. The board enforces proper restrictions. We have had more cases of scarlet fever than usual, but they were very mild—no deaths. There has been no vaccination for several years. About one-third of the school children are not vaccinated.

The board had eight regular meetings in the last year, depend almost entirely on the health officer. One hundred and twenty-five dollars was expended. There have been no prosecutions brought by the Board. Several legally notified, but complied in abating nuisances.

Infectious diseases reported during the year: Diphtheria, 4 cases; scarlet fever, 6 cases; typhoid fever, 2 cases.

SANDUSKY, ERIE COUNTY.

Dr. W. H. Busch, health officer.
Population (estimated), 20,000.

Our city is in good sanitary condition. The board of health has maintained an active organization the past year, doing everything in their power for the prevention of contagious diseases and abatement of nuisances.

Contagious diseases are reported by all physicians and houses placarded and a record kept of the same. Scarlet fever has been more prevalent than usual, but most of the cases were of a very mild form.

The board of health has held about eight meetings during the year. Total amount spent by board of health during the year is about \$2,100.

Infectious diseases reported during the year: Diphtheria, 14 cases; membranous croup, 8 cases; scarlet fever, 75 cases; typhoid fever, 14 cases; measles, 29 cases; other infectious diseases, 14 cases.

SCOTT, VAN WERT COUNTY.

Wm. Worthington, health officer.
Population (estimated), 600.

The town is in fairly good condition. Sewerage fairly good. Streets and alleys

in cleanly condition. There is no cause for complaint from lack of sewerage or improper discharge of sewage. There is no nuisance that the board is not able to abate.

Contagious diseases are properly reported and a record is kept. The board has been able to enforce proper restrictive measures. There were about 150 people vaccinated during the year. There are 180 unvaccinated children attending school.

SEBRING, MAHONING COUNTY.

Walter S. Crewson, health officer.
Population (estimated), 1,000.

The sanitary condition of this village is bad, owing to the fact that there is no sanitary sewerage. The board of health will recommend that sewers be built and in all probability council will take steps in this direction in the spring. The streets and alleys are in a pretty fair condition. All garbage is hauled to a dumping ground outside of the corporation. Owing to the newness of the town there has not been much night soil removed, but what has been was taken to a farm.

Most of the contagious diseases have been reported to the health officer in the year, but the doctors claim the board should furnish forms for them to report on. There has not been a complete record kept of these diseases. We do not know of any vaccinations here during the year. We have had more diphtheria than any other disease and have had very little trouble in enforcing quarantine.

The board of health have had about four meetings during the year, and have spent so far nothing. The board is only composed of four members beside the mayor and health officer, and as the law allows us six it is thought the board will have council appoint two more. There has been very few rules made by the board. They expect to meet this week and reorganize the board entirely, so as to be more effective in the coming year.

SENECAVILLE, GUERNSEY
COUNTY.

J. M. Rainie, health officer.

Population (estimated), 700.

The town is in good sanitary condition.

No contagious diseases other than diphtheria have ever been reported.

The board has had no difficulty in enforcing restrictive measures where diseases have been reported.

Have had only two board meetings in the past year.

Infectious diseases reported during the year: Diphtheria, 3 cases; typhoid fever, 1 case.

SEVEN MILE, BUTLER COUNTY.

Harry Jacobs, health officer.

Population (estimated), 350.

Board has been appointed, but has never organized. Sanitary conditions are good. Streets and alleys in fair condition.

SHELBY, RICHLAND COUNTY.

P. D. Longbrake, M. D., health officer.

Population (estimated), 4,696.

The village of Shelby is in very good sanitary condition. Our board meets regularly every two weeks and have been successful in all undertakings.

Streets, yards and alleys are in good condition. Our sewerage is good.

Contagious diseases are reported fairly well and a record of same is kept.

All school children were vaccinated just recently.

We have had about twenty meetings the past year.

Infectious diseases reported during the year: Smallpox, 3 cases; membranous croup, 2 cases; scarlet fever, 26 cases; typhoid fever, 7 cases.

SHILOH, RICHLAND COUNTY.

Dr. S. S. Holtz, health officer.

Population (estimated), 600.

Our village had no board of health last year up to six weeks ago. I was appointed health officer.

There were no contagious diseases in the village last year. Deaths and births have never been reported here, so I could not give any report as to that.

SHREVE, WAYNE COUNTY.

J. R. Wachtel, health officer.

Population (estimated), 1,050.

Sanitary condition of Shreve is good. Night soil removed in good order by a man provided with the necessary implements for the work.

Contagious diseases are properly reported and record kept. The diseases most prevalent were diphtheria and measles. Number of unvaccinated children estimated at 70 out of a total enrollment of about 200. Total amount paid out by the board of health for the year 1900, \$43.65.

The board met the first Thursday of every month.

We have had a great many cases of measles in 1901 — some 60 or 75 cases. Some were reported, others not.

Infectious diseases reported during the year: Membranous croup, 2 cases.

SIDNEY, SHELBY COUNTY.

Wm. C. Wyman, health officer.

Population (estimated), 6,000.

The streets, alleys and yards are in a cleanly condition. There is great cause of complaint from the lack of sewerage. The board has abated all nuisances. No arrangements have been made for the removal of night soil. The most was removed out in the country and farm land, and some dumped in the river, by parties not known to me who never got a permit. One party was arrested and bound over to Common Pleas court. Case not yet heard.

All contagious diseases are reported except typhoid fever, which was quite prevalent last year.

The board held ten meetings during the year. The total amount spent for the year was \$293.55. As a general thing all orders and notices sent out by the health officer were complied with within the time. One well was condemned and others in contemplation.

Infectious diseases reported during the year: Chicken pox, 3 cases; diphtheria, 1 case; membranous croup, 1 case; scarlet fever, 6 cases; whooping cough, 5 cases; measles, 3 cases; mumps, 1 case.

SMITHFIELD, JEFFERSON COUNTY.

Dr. W. H. Wood, health officer.

Population (estimated), 600.

Our streets and alleys are in fairly good condition. During the winter some accumulation of coal ashes, kitchen refuse manure from stables, etc., takes place. On the first of May notices are posted for all property owners to clean up inside of a specified time, usually 10 to 15 days. If not attended to, the street commissioner does the work and the costs are charged up to the property by the town council. Any nuisances found by board of health, either by the health officer or on complaint of individuals, are investigated and reported to council, and when necessary council takes the matter in hand. Our streets and alleys are well drained. The village, lying on a high ridge, has natural advantages in drainage. Only one case arose during the year in which the owner was compelled to clean up and extend his drain. Board had two meetings. Spent no money as a board.

Contagious diseases would be properly reported if any occurred. We have had no contagious diseases during the year except chicken pox, of which a few cases occurred. All our typhoid fever cases contracted the disease elsewhere. Due care was taken to disinfect the discharges from them, the people being

thoroughly informed of the nature of the disease and dangers of contracting it by failure to follow instructions as to food, drink, etc. No vaccinations were reported. But few children attend school who have not been vaccinated.

Infectious diseases reported during the year: Typhoid fever, 5 cases.

SMITHVILLE, WAYNE COUNTY.

D. H. Morgan, M. D., health officer.

Population (estimated), 500.

Streets and alleys are in fairly good condition. Some difficulties in obtaining proper drainage from cellars. No nuisances. The council has under discussion the drainage of a portion of one alley and removal of manure piles. Night soil is hauled away and either buried or safely disposed of in some other way.

Contagious diseases during past year have been properly reported. No special book of record is kept. The board is able to enforce restrictive measures. Probably no person was vaccinated during 1900. I presume no pupil in the public school has been vaccinated. There has not been a case of smallpox in the town for many years.

No meetings of the board were held. The work of the board has been done through the health officer. Only a small amount for incidentals. No prosecutions were brought.

Infectious diseases reported during the year: Scarlet fever, 1 case; measles, 1 case.

SOMERSET, PERRY COUNTY.

O. L. Iden, M. D., health officer.

Population (estimated), 1,200.

The board of health has had but one meeting during the year 1900. I was chosen health officer March 1st, 1900. Previous to that date there was no record kept, so I can not make a complete report. Expenditures during the year amount to about \$30.00.

The sanitary condition of the town is good. The drainage is good except in one locality, which should have a sewer.

Contagious diseases have been reported and quarantine enforced. Scarlet fever is the only contagious disease more prevalent than usual, except measles and chicken pox.

The health board of Somerset is a passive body except on question of quarantine in contagious diseases.

There has been no reports of deaths and their causes.

Measles, whooping cough, typhoid fever, etc., have never been reported.

Infectious diseases reported during the year: Scarlet fever, 20 cases.

SOUTH BLOOMFIELD, PICKAWAY COUNTY.

Charles E. Blacker, M. D., health officer.

Population (estimated), 250.

The streets, alleys and yards are fairly clean. We have no sewerage system. The principal streets have pebbled gutters. There were no nuisances reported in 1900.

There was not a single case of contagious disease in 1900. The superintendent of schools reports that there are 75 unvaccinated school children.

The board of health did not hold any meetings last year. The secretary's salary is \$5 a year. He has not yet been paid. There has not been any prosecutions, nor need of them.

SOUTH CHARLESTON, CLARK COUNTY.

Thomas G. Farr, M. D., health officer.
Population (estimated), 1,100.

Streets, alleys and yards are kept in fairly good condition, although a little more attention to keeping weeds cut during the summer months would be desirable. Sewers are in good condition except the outlet of one of the main

ones is somewhat defective, but council has taken the necessary action and the defect will be remedied in the spring. All nuisances have been abated without difficulty. Citizens willingly comply with all requirements of the board. Night soil is removed in tight barrels and deposited on the adjacent farms. Rubbish of all kinds is deposited on a dump ground by the village and all of the combustible parts burned.

The actions of our physicians is quite commendable inasmuch as they render all required assistance to the health officer by reporting all contagious diseases and also assist in rendering the quarantine effective where established. We have had more than our usual number of typhoid fever cases reported during the past fall. No vaccination during the past year. About 75 per cent. of school children reported as successfully vaccinated.

We have had no prosecutions—none required. The board has spent no money during the past year except for salaries of health officer, \$25.00; secretary, \$10.00 and sanitary marshal, \$15.00.

Infectious diseases reported during the year: Diphtheria, 3 cases; typhoid fever, 9 cases.

SPARTA, MORROW COUNTY.

S. G. Fowl, health officer.

Population (estimated), 220.

Infectious diseases reported during the year: Scarlet fever 4 cases.

SPENCERVILLE, ALLEN COUNTY.

Frederick Hirn, health officer.

Population (estimated), 2,000.

Sanitary condition at present is good. We have abated all nuisances. Our alleys are kept clean. We have prohibited manure and garbage to be thrown in streets or alleys. Our sewerage is fairly good, though could be better.

Contagious diseases are properly reported. The most prevalent disease was scarlet fever. The general health of

the village is good. We have no contagious diseases inside of corporation limits at present.

Board of health met regularly the first Monday of each month, and while we had scarlet fever and typhoid fever we met every two weeks.

Infectious diseases reported during the year: Scarlet fever, 15 cases; typhoid fever, 5 cases; measles, 6 cases.

SPRINGBORO, WARREN COUNTY.

John B. Blake, health officer.

Population (estimated), 500.

Sanitary condition good. Streets and alleys clean. Sewerage good. Night soil generally buried.

No contagious diseases the past year.

Board of health meets last Monday of the month. There were seven meetings last year. The expenditures were \$17.25.

The next week after I took the office I went to every house and examined all cellars, drains, privies, and all other places. Where everything was not all right I gave notice to abate the nuisance. In every case it was done without any trouble.

There is only one unvaccinated child attending school.

Infectious diseases reported during the year: Typhoid fever, 1 case.

SPRINGFIELD, CLARK COUNTY.

Henry H. Seys, M. D., health officer.

Population (estimated), 40,000.

Streets, alleys and yards are not in a cleanly condition. There is cause for complaint both on account of lack of sewerage and improper discharge of sewage. Measures are being taken which will give some relief as to latter. All night soil removed by private contract. Garbage removed mainly by one party who has contract with the city. Service not good.

Contagious diseases are reported in the majority of cases except as noted hereafter. Typhoid fever not reported.

Have not tried to compel such report because of the many cases of failure to diagnose correctly. A large number of cases of whooping cough are not seen by a physician, and therefore escape report. A record of all cases reported is kept. The board has enforced restrictive measures. No contagious disease has been especially prevalent, except possibly a few more cases of typhoid fever, mainly among those drinking water from wells. Very few have been vaccinated during the year, because of the fact that in the fall of 1898 vaccination was very thorough, due to threatened epidemic of smallpox. Very few school children are unvaccinated.

The board of health, which is the board of public affairs meets weekly, and is prompt to act when requested by health officer. Total expenditure during year, \$4028.46. No prosecutions brought.

Infectious diseases reported during the year: Smallpox, 2 cases; diphtheria, 29 cases; membranous croup, 7 cases; scarlet fever, 83 cases; typhoid fever, 17 cases; whooping cough, 3 cases; measles, 116 cases.

SPRING VALLEY, GREENE COUNTY.

Arch Copsey, health officer.

Population (estimated), 600.

The village is in fine condition, with the exception of one thing and that is caused by the overflow of the Little Miami river. The pike leading from the village to the river is high and it causes the water to back up into the western part of the town and some of the houses have from 3 to 3½ feet of water in them. The pike was put up by the county.

We have a well organized board in our village. We meet once a month regularly. We have not had any trouble in the prevention of any diseases or keeping things well cleaned up.

There has not been many contagious diseases, but all that occurred have been properly reported and looked after.

Almost all the school children have been vaccinated.

Infectious diseases reported during the year: Diphtheria, 1 case; typhoid fever, 2 cases; measles, 1 case.

STRASBURG, TUSCARAWAS COUNTY.

Dr. J. C. Schutzbach, health officer.

Population (estimated), 550.

The main street is not properly drained. There is a great deal of stagnant surface water in streets and alleys. Privies are only holes dug in ground. Board met 12 times.

Infectious diseases reported during the year: Diphtheria, 2 cases; membranous croup, 1 case; typhoid fever, 3 cases; whooping cough, 14 cases.

SUGAR GROVE, FAIRFIELD COUNTY.

S. Renshaw, M. D., health officer.

Population (estimated), 400.

The sanitary condition of the village is good. No complaint reached the board during the year.

Contagious diseases are properly reported. The board has not been able to enforce proper restrictive measures. No vaccinations during the year.

No meetings during the year by our board.

Infectious diseases reported during the year: Measles, 1 case.

SUMMERFIELD, NOBLE COUNTY.

Alva G. Wharton, health officer.

Population (estimated), 500.

The condition of our village is good, as it is drained very well naturally, being situated on a ridge. The board of health has maintained an active organization.

Contagious diseases are generally reported. No vaccinations during year.

The board has held six meetings. No prosecutions.

Infectious diseases reported during the year: Whooping cough, 20 cases.

SYCAMORE, WYANDOT COUNTY.

Dr. W. H. Wickham, health officer.

Population (estimated), 850.

Our board of health has not held a meeting during the past twelve months. We have had no epidemics of any kind during that period.

No contagious diseases have been reported to me. I consider the sanitary condition of our village good. We have had no trouble with our citizens regarding sanitary laws. Night soil is taken out of the village and usually buried. There are no nuisances existing to my knowledge.

I have been unable to ascertain number of unvaccinated school children. So far as I know, no contagious diseases are reported. I do not believe that my predecessor kept any record of the reports. There have been no arrests or suits at law during my term of office.

SYLVANIA, LUCAS COUNTY.

G. A. Crandall, health officer.

Population (estimated), 645.

Streets, alleys and yards are in a cleanly condition. There is no cause for complaint on account of sewerage. There are no nuisances which the board has been unsuccessful in abating. No arrangements made for the disposition of night soil and garbage.

Contagious diseases are properly reported and a record kept. Restrictive measures have been enforced. Scarlet fever and measles have been more prevalent than usual. So far as known, no one was vaccinated during the year. There are 140 unvaccinated children attending school.

The board held three meetings and expended \$30.00. There were no prosecutions.

Infectious diseases reported during the year: Scarlet fever, 18 cases; whooping cough, 1 case; measles, 28 cases.

TIFFIN, SENECA COUNTY.

Dr. A. C. Schwartz, health officer.
Population (estimated) 12,000.

Our board has maintained an active organization and has been successful in enforcing proper measures for the prevention of diseases. All streets, alleys and yards are clean. There is no cause for complaint from lack of sewerage or improper discharge of sewage. We have a garbage collector who is appointed by the board and a scavenger who has a permit from the board to remove all the night-soil.

Contagious diseases are reported and a record kept. The board has been able to enforce strict measures. Scarlet fever and diphtheria have been more prevalent in the last year than for several years past.

The board has held twenty-four meetings during the year and spent \$1,165.

Number of unvaccinated children in all schools, about 1700. Estimated number of pupils vaccinated during year, about 30.

Infectious diseases reported during the year: diphtheria, 36 cases; membranous croup, 17 cases; scarlet fever, 70 cases; typhoid fever, 27 cases; measles, 16 cases.

TIPPECANOE CITY, MIAMI COUNTY.

C. R. Moser, health officer.
Population (estimated) 2,000.

Streets and alleys are in good condition. Some sewers would be an improvement. No failure to abate nuisances.

Contagious diseases are properly reported, but no record is kept. Restrictive measures are enforced. Scarlet fever has been more prevalent than usual.

The board has held seven meetings and expended \$120.95. Fines were collected in three cases—one for violating regulation as to hogs, one for violating quarantine and one for burying without permit.

Infectious diseases reported during the year: Scarlet fever, 3 cases.

TOLEDO, LUCAS COUNTY.

L. C. Grosh, M. D., health officer.
Population (estimated) 150,000.

Streets and alleys are in good condition. The sewerage system is inadequate, especially in the down-town districts, the water passing off smooth pavements much quicker than it did previously, resulting in the sewers backing up through the catch basins, most of which are located in the cellars of the down-town district, and depositing their contents, which have been accumulating for various lengths of time.

No nuisances remain unabated.

Property holders, agents, tenants, etc., have night-soil removed by licensed vault cleaners, who use tight barrels and take it out in the country to dispose of it on farms. The garbage is disposed of by contract let by the council, and the contractor plows it under in the country.

Contagious diseases are properly reported and a record is kept. Restrictive measures are enforced. Scarlet fever has been the most prevalent contagious disease. Impossible to ascertain number of unvaccinated school children.

The board met on an average of twice a month and expended \$13,500.00.

Thirty-eight prosecutions brought. Two, adulterated provisions; convicted. One, preserved milk; fined. Six, adulterated milk; fined. Four, milk from which cream had been removed, three fined and one thrown out on a technicality. Depositing vault contents in ditch, neglecting to clean vault, putting contents of vault in hole, allowing vault cleaning outfit to remain in public alley, dumping mixed rubbish on lot, all fined. Dumping mixed rubbish, dismissed. Permitting premises to become a nuisance, store garbage stored near tenants, both fined. Failing to abate nuisance and make repairs,

two cases, time extended and work done. Bill-board case, dismissed for lack of proof. Three cases, violation cow ordinance, dismissed with lecture, and seven fined for same violation. Two cases of residing in and working from house carded for contagious diseases, both fined. Domestic in house carded for contagious disease fined for leaving without having clothes fumigated. Mother and children violating quarantine, house carded for contagious disease, fined.

Infectious diseases reported during the year: Smallpox, 4 cases; diphtheria, 455 cases; membranous croup, 96 cases; scarlet fever, 895 cases; typhoid fever, 49 cases; whooping cough, 6 cases; measles, 668 cases; chicken-pox, 27 cases.

TROY, MIAMI COUNTY.

E. N. Loy, M. D., health officer.

Population (estimated) 6,000.

Our town is in a fair sanitary condition, considering the lack of sanitary sewerage, which is needed badly, especially in the business portions of the city. We have a splendid system of water works and are recommending the use of the hydrant water exclusively, as we consider all well water as being unfit to use. All night-soil is removed in sealed barrels, and the garbage in the same manner.

The board of health has had no trouble in having contagious diseases reported or in establishing quarantine. It has not been necessary to make any arrests during the past year. There have been a few vaccinations during the year, but we have no way of ascertaining the number of school children that have been vaccinated. The board of health holds monthly meetings and has spent in the past year about \$265.00.

We have had twenty-three deaths from consumption, which is about one-fourth the total number from all causes. This would suggest that we need some sort of quarantine for the tuberculous patients. At the present we have no

quarantine law which applies to this disease.

Infectious diseases reported during the year: Diphtheria, 2 cases; scarlet fever, 14 cases.

UHRICHSVILLE, TUSCARAWAS COUNTY.

James A. McCollam, M. D., health officer.

Population (estimated) 5,000.

The board of health held eleven meetings in 1900 and spent \$250.38; caused five arrests; one for violation of board of health regulation; four for violation of village ordinance concerning nuisances. Each party was convicted. Three paid fines; one appealed and had his fine remitted by abating the nuisance.

The streets, alleys and lots are in fair condition. There are two small sections of our town that need sanitary sewers. This matter is now before the council. We are proud of our sewer system, both as to quantity and to quality. We think in these respects we are one of the first towns in the State. We have to report over 1,100 feet of sewers constructed in 1900. The only complaint we have is one of our outlet sewers that empties into the creek between Uhrichsville and Denison; this will need to be changed in a year or two. We have a licensed scavenger and he arranges as to disposal of night-soil. We have had very little trouble having orders obeyed. We investigated and found 231 nuisances and issued 107 legal notices to abate same. Others were abated without legal notice. Have succeeded in almost every effort.

Physicians, as a rule, are prompt in reporting contagious diseases, but do not report births, as our other regulations require. Undertakers must file physician's certificate to obtain a burial permit, so deaths are reported. We have a book to record births, deaths, and contagious diseases, but it has not been used this year. We have had no

trouble with quarantine regulations. Had quite a number of cases of typhoid fever both in 1899 and 1900. The whooping cough epidemic of 1899 lasted into the early part of 1900. Our mortality report shows eleven deaths from whooping cough. These cases nearly all had pneumonia or brain trouble as a complication. At the first outbreak of smallpox in Dennison the board of health asked the school board to have school children vaccinated, which was done, being opposed by a very few. An estimate is that about 300 persons were vaccinated and that now from 150 to 175 pupils have not been vaccinated. We have paid some attention to our milk supply—adopting regulations for registration and have made some tests. The most serious problem that confronts our board is our wells and typhoid fever. In 1899 we had fifty-five cases and eight deaths. In 1900 we had sixty-three cases and two deaths, or about 8.5 per cent. for the two years. Probably there were some that were not reported. Of fifty-five cases in 1899, forty-three were reported as using well water exclusively. Of forty-one cases reported in July, August and September, 1900, thirty-seven were reported as using well water, so we feel that we must, at least, investigate our wells and see if they are at fault.

Aside from this the most pressing needs of our town, from a sanitary point of view, are the sewers above mentioned, and to have the channel of the creek cleaned.

Infectious diseases reported during the year: Diphtheria, 2 cases; membranous croup, 2 cases; scarlet fever, 10 cases; typhoid fever, 63 cases; whooping cough, about 40 cases; measles, 36 cases; chicken-pox, 17 cases.

UNION CITY, DARKE COUNTY.

Dr. Wm. M. Grimes, health officer.

Population (estimated), 2,000.

Sanitary condition of Union City is up to the average, I think. No cause

for complaint on account of sewerage. The board has been successful in the abatement of nuisances. Night soil and garbage is removed in wagons by order of the board.

Contagious diseases are properly reported and a record is kept. The board has been able to enforce proper restrictive measures. Contagious diseases have not been very prevalent the past year. As near as the superintendent of schools is able to tell, there are 250 unvaccinated children attending the public school. I think there has been very little vaccinating, if any, done here during the past year.

The board has held five regular meetings during the year. Money expended, \$51.37. The board has brought no prosecutions during the year.

Infectious diseases reported during the year: Typhoid fever, 9 cases.

URBANA, CHAMPAIGN COUNTY.

C. C. Craig, M. D., health officer

Population (estimated), 7,000.

The Urbana board of health has met once every month during the year with but few exceptions. We have had no law suits nor had trouble in enforcing our restrictions. The board has had a sanitary policeman employed throughout the year who has visited streets, alleys and yards every week, keeping them in as good condition as is possible without sewerage. Sewerage is the most needed improvement of this city. Night soil is hauled away between the hours of 10 p. m. and 4:30 a. m. in tight tanks. Garbage is disposed of by those feeding hogs on the outskirts of the city, the garbage being placed in barrels for them.

Contagious diseases are promptly reported by means of cards, which the board of health had printed and placed with every physician of the city. There have been very few cases of contagious diseases in the city during the year, except measles, which were of mild form. There being very few now who have not

been vaccinated, we did not vaccinate more than 25 during the year. The board has not been at any great expense, spending about \$500.

Infectious diseases reported during the year: Scarlet fever, 5 cases; typhoid fever, 5 cases; whooping cough, 1 case; measles, 30 cases.

UTICA, LICKING COUNTY.

Dr. G. W. Garrison, health officer.
Population (estimated), 800.

Streets and alleys are in good sanitary condition. No complaint on account of lack of sewerage. There are two nuisances within corporation, each of which should be abated. First, the B. & O. R. R. shipping pens. I cannot induce them to keep the same clean. In hot weather the drippings from stock allowed to occupy these pens becoming decomposed, renders the air very noxious. My authority does not seem to be of any avail. Second, stock yards with scales for weighing live stock in connection. These are terribly bad at all times in soft weather. Night soil is buried in lots.

Board does not meet regularly except when a contagious disease prevails, then our board meets regularly once a month. Board spent on smallpox cases within village about \$250. No prosecutions brought.

Infectious diseases reported during the year; Smallpox, 3 cases; typhoid fever, 1 case; whooping cough, 5 cases.

VAN BUREN, HANCOCK COUNTY.

D. H. Heistand, mayor.
Population (estimated), 400.

Streets, alleys and yards are in clean condition. Sewerage first class. Just completed. No nuisance to abate.

Contagious diseases are properly looked after by the physicians and mayor. When necessary to quarantine the same is done. There are 100 unvaccinated children attending school.

We established a board of health four years ago this summer and passed a full set of sanitary regulations, but it was impossible to keep a council and board of health at the same time on account of the fact that so many of our citizens are people working in the oil field and moving in and out of the village to and from their location or place of employment.

Infectious diseases reported during the year: Typhoid fever, 1 case; whooping cough, 13 cases; other infectious diseases, 1.

VANDALIA, MONTGOMERY COUNTY.

Dr. W. H. Riley, health officer.
Population (estimated), 350.

Board of health has maintained an active organization. Streets, alleys and yards are kept in a cleanly condition. No cause for complaint. No nuisances abated. No arrangements for removal and disposition of night soil.

Contagious diseases are reported but no record is kept. Diphtheria and scarlet fever have been most prevalent the past year. No children vaccinated during the year. About 35 unvaccinated.

Three meetings of board held since organization in June. No expenditures except for supplies. No prosecutions.

VAN WERT, VAN WERT COUNTY.

Dr. C. G. Church, health officer.
Population (estimated), 7,000.

Streets, alleys and yards in good, fair condition. Van Wert has the unsanitary Town run, which the local board has tried to remedy to no avail, because the town is so heavily bonded already for other less important improvements. Night soil and garbage are removed in air-tight containers and conveyed to city dumping grounds; there it is dealt with according to provisions of the law concerning such matters.

Contagious diseases are reported in compliance with instructions from state

board. There is, however, some laxity in local physicians reporting typhoid fever. A careful record of all contagious diseases is kept. The board enforces proper restrictive measures. Scarlet fever has been prevalent in a small way since last August. No deaths. Have no way of ascertaining number of vaccinations during 1900. However I may say they have been very few. Number of unvaccinated children, 650.

The local board has held six meetings during the past year. Total amount spent, \$501.41. The board has prosecuted one man for keeping hogs within the limits. He was fined \$5.00 and costs and hogs moved out.

Infectious diseases reported during the year: Smallpox, 1 case; diphtheria, 1 case; scarlet fever, 41 cases; measles, 1 case; other infectious diseases, 5 cases.

VERMILLION, ERIE COUNTY.

B. S. Horton, health officer.

Population (estimated), 1,500.

The village of Vermillion has been free from all infectious diseases during the time I have held the position of health officer. The sanitary condition is fairly good. It is the aim of the Board and the health officer to keep it free from any filth that will breed disease of any kind. You will notice that the deaths are most of them constitutional and I might say are nearly all persons well advanced in years.

The board expended about \$50.

Infectious diseases reported during the year: Scarlet fever, 1 case.

VERSAILLES, DARKE COUNTY.

C. F. Ryan, M. D., health officer.

Population (estimated), 1,700.

Infectious diseases reported during the year: Scarlet fever, 40 cases; typhoid fever, 29 cases.

VINTON, GALLIA COUNTY.

Joel A. Pugh, health officer.

Population (estimated), 315.

There was no organized board of health until December 26, 1900, the old board having become defunct and no meetings having been held since September, 1895. The council acted as a board of health during the interval, but no record was kept of anything pertaining to such business separate from council recorded by clerk.

Streets, alleys and yards not in a proper sanitary condition. No sewerage system. No reported nuisances that have not been abated. No arrangements for disposition of night soil and garbage.

It is doubtful whether reports are made of all contagious diseases. No records are kept. Board not very effective as to restrictive measures. Measles the only contagious disease known to be prevalent. Perhaps 35 have been vaccinated. Probably fifty unvaccinated children in schools.

Board organized December 26 and met December 27, 1900.

Infectious diseases reported during the year: Typhoid fever, 3 cases; measles, probably 20 or 25.

WADSWORTH, MEDINA COUNTY.

Dr. C. N. Lyman, health officer.

Population (estimated), 2,000.

The sanitary condition of the town is fair. The board is in good working order. The streets and alleys well attended to. There is complaint of improper sewerage. An attempt was made to correct it, but the village council defeated the effort. Night soil and garbage is gathered by a scavenger and carried outside the corporation and used as fertilizer.

But few cases of contagious diseases are reported, as but few have occurred. The board has succeeded very well in restrictive measures. There has not been a case of vaccination in this district for the last ten years that has come to my knowledge. The last report of the super-

intendent to me was that there were 250 unvaccinated children attending school.

The health board has held 12 meetings and have authorized the expenditure of about \$75.

Infectious diseases reported during the year: Diphtheria, 4 cases; membranous croup, 1 case; scarlet fever, 1 case; typhoid fever, 2 cases.

WAPAKONETA, AUGLAIZE COUNTY.

A. Kohler, health officer.

Population (estimated), 4,000.

Streets, alleys and yards are kept clean. The sewerage is not what it should be. We need a sewer along the river, but have not yet succeeded in procuring said sewer.

Contagious diseases are not always reported. No record kept of diseases. We quarantine all contagious diseases reported.

The board held eight meetings during 1900, and expended \$126.00.

Infectious diseases reported during the year: Membranous croup, 1 case; whooping cough, 1 case.

WARREN, TRUMBULL COUNTY.

Dr. D. E. Hoover, health officer.

Population (estimated), 10,000.

Streets and alleys are kept clean. There is lack of sewerage on Woodland avenue, and Charles and Fremont streets. The board has failed to abate the nuisance caused by sewage emptying into river at Market street bridge. Night soil and garbage are removed by contractors to city dump grounds, and then treated and sold as fertilizer.

Contagious diseases are properly reported. We keep a record of all such diseases. Restrictive measures are enforced. More measles and membranous croup than usual. Probably two to three hundred vaccinated during past year. Number of unvaccinated children attending school, 400.

The board held twenty-two meetings during the year, four of which were special. Total amount expended was \$1019.06. Three prosecutions during the year, fines imposed and collected in all. One for dumping rubbish or garbage in improper place. One for removing dead body, and one for removing night soil.

Infectious diseases reported during the year: Diphtheria, 15 cases; membranous croup, 8 cases; scarlet fever, 16 cases; typhoid fever, 15 cases; whooping cough, 6 cases; measles, 112 cases; other infectious diseases, 2 cases.

WASHINGTON C. H., FAYETTE COUNTY.

J. M. Edwards, health officer.

Population (estimated), 6,000.

Washington is in as good sanitary condition as can be with our imperfect system of sewerage. Our streets and alleys are kept as clean as any city of its size in Ohio. Our night soil is removed in the night. Our board of health has not met regularly, but meet at the call of the president. You will see that we have escaped contagious diseases wonderfully. We have had no trouble. No arrests.

The board of health have but little to do. The health officer does it all.

Infectious diseases reported during the year: Diphtheria, 4 cases; membranous croup, 2 cases; scarlet fever, 4 cases; typhoid fever, 7 cases; whooping cough, 2 cases; measles, 1 case; other infectious diseases, chickenpox, 1 case.

WAVERLY, PIKE COUNTY.

James J. Emmett, health officer.

Population (estimated), 2,000.

Streets, alleys and yards are in a fairly good sanitary condition. There is no complaint on account of sewerage. The board has had trouble with one slaughter house, which refuse to re-

move to limit, as the rest have done. Night soil is removed to adjacent farms in sealed casks.

Contagious diseases are all reported and a record kept. The board has been able to enforce restrictive measures. Scarlet fever, of a mild type, has been the most prevalent contagious disease. About 100 were vaccinated during the year. There are 154 unvaccinated children attending school.

The board held nine meetings, and expended \$475.07. No prosecutions.

Infectious diseases reported during the year: Smallpox, 2 cases; scarlet fever, 10 cases; whooping cough, 5 cases; other infectious diseases, 1 (death).

WAYNESBURG, STARK COUNTY.

Dr. E. G. McCormick, health officer.

Population (estimated), 650.

Sanitary conditions are good. It seems impossible, in a village like this, to get six men who have interest enough in matters of this kind, under normal conditions, to keep up an active board of health. In my opinion the thing is a failure as it now is.

Not one person has been vaccinated.

The board has not met more than once within the past year. The health laws should be changed.

Infectious diseases reported during the year: Membranous croup, 1 case; typhoid fever, 1 case; whooping cough, 5 cases.

WAYNESFIELD, AUGLAIZE COUNTY.

F. M. Berry, health officer.

Population (estimated), 650.

We have been favored with remarkably good health the past year. Have had no contagious diseases except a few cases of whooping cough and measles, and most of those were in mild form and needed but little treatment. We have not had a death in the corporation since last June, and only five during the year. Our streets and alleys are

kept in a cleanly condition. Our sewerage is working satisfactorily. Our people are always willing to submit to all necessary sanitary precautions. No one has been vaccinated during the year, as nearly all had been vaccinated a year or two previously.

Our board of health meets monthly and nearly all work done has been voluntary for the good of the town. Of course in the event of contagious diseases when expenses are necessary, our board stands willing and ready to attend to all duties properly, regardless of the expense, and we have in this work, the co-operation of the citizens and village council.

Infectious diseases reported during the year: Whooping cough, 2 cases; measles, 2 cases.

WELLSTON, JACKSON COUNTY.

Thomas McGuire, health officer.

Population (estimated), 3,000.

Streets, alleys and yards are in good sanitary condition. There is no reason for complaint from lack of sewerage. The board has been successful in abating all nuisances. We have a regular system for removing garbage and night soil.

Contagious diseases are reported promptly and record is kept of same. Smallpox has been more prevalent than usual. None vaccinated during the year.

Twelve meetings of the board were held, and about \$30.00 was expended. No prosecutions.

Infectious diseases reported during the year: Smallpox, 85 cases; typhoid fever, 2 cases.

WELLSVILLE, COLUMBIANA COUNTY.

J. T. Warren, health officer.

Population (estimated), 6,300.

Streets and alleys are not kept in a cleanly condition. There is a system of sewerage under construction, but it is not yet completed. All nuisances have been successfully abated that have been

undertaken. Night soil is hauled away in the night and buried. No arrangements are made for the disposal of garbage.

Contagious diseases are properly reported and a record of such diseases is kept. Proper restrictive measures have been properly enforced. Diphtheria has been more prevalent than other contagious diseases. From 500 to 600 were vaccinated last year. There are 212 children unvaccinated attending public and parochial schools.

Board of health held twelve meetings. Total amount expended, \$1,237.64.

Infectious diseases reported during the year: Smallpox, 19 cases; diphtheria, 128 cases; membranous croup, 5 cases; scarlet fever, 3 cases; typhoid fever, 46 cases; whooping cough, 50 cases; measles, 100 cases; other infectious diseases, 40 cases.

WESTERVILLE, FRANKLIN COUNTY.

James D. Budd, health officer.
Population (estimated), 1,450.

Infectious diseases reported during the year: Scarlet fever, 2 cases; typhoid fever, 4 cases; whooping cough, 1 case; measles, 5 cases.

WEST JEFFERSON, MADISON COUNTY.

W. R. Borland, health officer
Population (estimated), 1,500.

Streets and alleys are in excellent condition. Sewerage good. Have privy vaults 6 to 7 feet deep. When full we fill them up with soil.

Contagious diseases are promptly reported and a record is kept. Have been able to enforce restrictive measures. No vaccinations. There are 40 unvaccinated children attending school.

Board held eight meetings. Money expended, \$34.00.

Infectious diseases reported during the year: Typhoid fever, 3 cases.

WEST LEIPSIC, PUTNAM COUNTY.

M. L. Pritchard, health officer.

Population (estimated), 500

No report to make except that we have had four regular meetings, and our village is and has been, in good sanitary condition during the year.

WEST MANCHESTER, PREBLE COUNTY.

Lewis Osterhaus, health officer.

Population (estimated), 500.

The sanitary condition of streets and alleys is, I think, very good. We have been hauling out all filth and rubbish twice a year. Our little town has been remarkably healthy until the "grippe" struck it, but not worse than in other surrounding villages.

We have had no contagious diseases in town the last year, but when we have, we use the best means known to stamp them out quickly.

The board of health has had, I believe, four regular meetings. Total amount spent, about \$40.00. Have had no prosecutions, and there has been no violations of the law.

WEST MANSFIELD, LOGAN COUNTY.

William M. Goff, M. D., health officer.

Population (estimated), 875.

The streets, yards and alleys are in a very good condition. There are no causes for complaint at present of lack of sewerage, or improper discharge of sewage. There are no nuisances which the board has not successfully abated. Garbage and other matter is removed by the proper officials.

Contagious diseases are not always properly reported but a record is kept of those that are reported. The board has not been wholly successful in enforcing proper restrictive measures. Scarlet fever has been more prevalent

than any contagious disease. I do not know of any persons that have been vaccinated during the year. There are enrolled at public schools 190 pupils. Out of this number 113 have not been vaccinated.

The board has had about five or six meetings during the year. There has been no prosecutions brought by the board. The board has expended about \$20.00 during the year.

WEST MILTON, MIAMI COUNTY.

Dr. Gainor Jennings, health officer.
Population (estimated), 904.

The present sanitary condition of our village is good. Our streets, alleys and yards are in a cleanly condition. We have no sewerage system. There are no nuisances which the board has unsuccessfully tried to abate. Night soil and garbage is deposited on the Sleppy farm across the river from the village.

Contagious diseases are properly reported. A record is kept. Board enforces proper restrictive measures. A few mild cases of scarlet fever, only, occurred. No persons vaccinated during the year. About fifty unvaccinated children attend West Milton public schools.

Board held one meeting during the year. Seventy-six dollars and sixty cents is the total amount spent. No prosecutions brought by board for violations of its orders or health laws.

Infectious diseases reported during the year: Scarlet fever, 3 cases.

WESTON, WOOD COUNTY.

George B. Spencer, health officer.
Population (estimated), 1,000.

Our streets and alleys are in a fairly good condition. There have been no diseases or deaths which could be traced to unsanitary conditions. With one sanitary police. I have tried to keep our town in fairly good condition. While all our surrounding towns have been

visited with typhoid fever with much fatality, we have not had a case in our corporate limits, only one case of very mild form of scarlet fever occurred. Our night soil is deposited in ground vaults or on ground surface and removed as the sanitary conditions require. We have no system of sewerage, except a few strings of tile. No vaccinations during year. There are by careful estimate perhaps one half of our school children unvaccinated.

Our contagious diseases are reported and properly quarantined. and houses placarded.

Our board of health has had no meetings, no conditions arising necessitating meetings, the health officer and sanitary policeman having full authority to abate nuisances, and look after the sanitary welfare of the town. Have had no prosecutions for violating sanitary rules.

Infectious diseases reported during the year: Scarlet fever, 1 case; chicken pox, 3 cases.

WEST SALEM, WAYNE COUNTY.

Eli Rupert, president board of health.
Population (estimated), 650.

The present sanitary condition of our village is good. Proper measures have been taken in the prevention of contagious diseases. Streets and alleys are in fair condition. We have no complaint in that line.

Contagious diseases have been properly reported.

Our board has had three meetings during the year. Amount spent by the board during the year \$15.00. We have had no prosecutions during the year. Estimated number vaccinated during year, 20.

Infectious diseases reported during the year: Smallpox, 2 cases; typhoid fever, 7 cases.

WHARTON, WYANDOT COUNTY.

A. E. Baker, health officer.
Population (estimated) 550.

Our streets, alleys and yards are in very good sanitary condition. The sewerage has given no complaint. The board has had no trouble in abating any nuisances that have been reported or come under their observation. The only trouble is that the physicians seem to ignore the board by not reporting the cases they have and the deaths and births, which makes it inconvenient for the board to make out accurately the monthly and annual reports.

The health of the village has been very good during the year, having no contagious diseases except the whooping cough.

The regular meeting of the board is the first Tuesday night of each month and if necessary meet oftener. It is difficult to report the number of deaths without the co-operation of the physicians, as our secretary has no other source of information other than his own knowledge.

The amount expended by the board has not been more than \$12 for the year.

Infectious diseases reported during the year: Whooping cough, 2 cases; other infectious diseases, 3 cases.

WILLIAMSPORT, PICKAWAY COUNTY.

C. D. Briner, M D., health officer.

Population (estimated) 600.

Streets, alleys and yards are in a cleanly condition. There is no complaint on account of sewerage. We have a man employed to remove night-soil and garbage.

Contagious diseases are not always reported. A record of such diseases has never been kept. The board has not heretofore been able to enforce restrictive measures. I do not know of any vaccination during the year. Probably 60 or 75 per cent. of the school children are unvaccinated.

Four meetings of the board were held. Amount expended, \$64.15. There has been no prosecutions.

WILLOUGHBY, LAKE COUNTY.

Dr. George B. Durban, health officer.

Population (estimated) 1,900.

Streets, alleys and yards are in a cleanly condition. There is no complaint on account of lack of sewerage. There are no nuisances which the board has not successfully tried to abate. Night-soil and garbage is hauled away and buried.

Contagious diseases are properly reported and a record is kept. The board of health has been able to enforce proper restrictive measures. Scarlet fever has been more prevalent than usual. Twelve or fifteen persons probably were vaccinated during the year. There are 140 unvaccinated children attending school.

Board spent during the year, \$36.00.

Infectious diseases reported during the year: Scarlet fever, 3 cases.

WILLSHIRE, VAN WERT COUNTY.

Dr. S. K. Christy, health officer.

Population (estimated) 650.

The present sanitary condition of the village is good. We have maintained an active organization of the board for the last year and have been successful in enforcing proper measures for the prevention of contagious diseases, with the exception of whooping cough. Last March and April there was an epidemic of whooping cough in the town; cases were not reported and one death resulted from it—the only one from a contagion for the year. The streets, alleys and yards have been kept in a fairly cleanly condition. The only nuisance which we have to contend with is in keeping privies clean. Most of the privies either have a shallow pit or none at all, or a box to receive the excrement. We enforced the cleaning in the spring and many thought that was sufficient for the whole year. All garbage that will burn is burned on the premises

and night-soil is buried in trenches from one to three feet deep.

Contagious diseases are, as a general thing, not reported. Whooping cough has been more prevalent than any other contagious disease. To my knowledge there has not been any vaccinations.

The board of health has had seven meetings during the year and has expended \$78.00.

Infectious diseases reported during the year: Scarlet fever, 4 cases; typhoid fever, 2 cases; whooping cough, 1 case.

WILMINGTON, CLINTON COUNTY.

A. T. Quinn, M. D., health officer.

Population (estimated) 4,000.

The streets, alleys and yards are cleanly and in good sanitary condition. The sewerage very good. The night-soil and garbage is removed outside of the corporation.

All contagious diseases are reported and a record kept. Number of vaccinations not reported.

The board of health meets once a month, and oftener, when necessary. The council pays the expenses of the board of health. No prosecutions for violation of health laws were necessary.

WINDHAM, PORTAGE COUNTY.

H. I. Higley, health officer.

Population (estimated), 1,000.

Sanitary condition, good.

Contagious diseases are properly reported and a record kept of such diseases. The board of health enforces proper restrictions. Measles most prevalent. None vaccinated. Only about ten per cent. of school children vaccinated.

Meetings of board of health, one every month, besides some called meetings. No prosecutions brought by board of health.

Infectious diseases reported during the year: Measles, 28 cases.

WINTON PLACE, HAMILTON

G. C. Wildman, health officer.

Population (estimated), 1,400.

The board of health of Winton Place has maintained an active organization, and has taken all possible measures to prevent spreading of contagious diseases. Diphtheria and typhoid fever have been more prevalent than usual. Being near the city of Cincinnati, it is impossible to give number vaccinated, but very few attend the public school that are not vaccinated.

The board meets once each month. We have brought no prosecution. The expense of the board is about \$125.00 per year.

Infectious diseases reported during the year: Diphtheria, 8 cases; scarlet fever, 1 case; typhoid fever, 3 cases; measles, 1 case.

WOOSTER, WAYNE COUNTY.

Dr. Joseph E. Barrett, health officer.

Population (estimated), 8,000.

Our streets and alleys are in good condition. The sewerage is quite good. Excellent wagons are provided for night soil, equipped and willing to do the work at night and quietly.

Contagious diseases are reported and a record kept. Scarlet fever and diphtheria have been the most prevalent contagious diseases. Vaccination wholly neglected. Not one-eighth of the scholars are vaccinated.

No suits have been brought.

Infectious diseases reported during the year: Diphtheria, 26 cases; scarlet fever, 17 cases.

WORTHINGTON, FRANKLIN COUNTY.

Dr. D. H. Welling, health officer.

Population (estimated), 443.

Our board has not been in good working condition during the last year, owing to failure of newly appointed member to qualify. Will put our board in good working order this spring. We

have had garbage and all such matters attended to by removal.

Infectious diseases reported during the year: Diphtheria, 4 cases; scarlet fever, 5 cases; typhoid fever, 8 cases.

WYOMING, HAMILTON COUNTY.

Geo. Stoddard, health officer.

Population (estimated), 1,800.

In making my report for the year ending Dec. 31st, 1900, I am happy to say that we have had no run of contagious diseases in past year. Our death rate while seeming large, comes from our old residents. Out of 21 deaths in this village for past year, nine were over 70 years, with an average of 75 years, four over 50 years, three from 30 to 50 years, and five below 30 years.

The sanitary condition of our village is good. All the streets and alleys are kept in a cleanly condition. The village council uniting with the health board, and placing all their police officers under control of the health officer as "sanitary police." We have a system of sewerage that covers most of the village. Night soil is removed by permit of health officer, and buried, a sanitary officer having to examine its proper disposition, and to certify to each permit and return to health officer.

All contagious diseases are properly reported by the physicians. Complete record is kept of the same, and all such cases properly placarded. Have had only two cases of contagious disease in past year. At the time of our smallpox scare, two years ago, we had compulsory vaccination, among the colored people of the village, and the school board required every child to be vaccinated or show a proper certificate from a physician before attending school. This order was strictly enforced, and at that time I do not think that there were 50 vaccinated people in the village.

The board of health has had but few regular meetings in the past year, although in touch, there has been but little to call the members together, for

everything is working smoothly in the village. Our expenses for the year have run about \$125.

Infectious diseases reported during the year: Diphtheria, 1 case; scarlet fever, 1 case.

XENIA, GREENE COUNTY.

Dr. A. D. DeHaven, health officer.

Population (estimated), 8,000.

Will have a sewerage system soon.

Contagious diseases are properly reported. Scarlet fever in mild form has been the most prevalent contagious disease.

The board meets twice per month, six months in the year, and once per month the other months. I haven't the amount at hand of the expenditures of the board. No prosecutions have been made.

Infectious diseases reported during the year: Diphtheria, 13 cases; scarlet fever, 26 cases.

YOUNGSTOWN, MAHONING COUNTY.

H. E. Welch, M D., health officer.

Population (estimated), 44,885.

Infectious diseases reported during the year: Smallpox, 14 cases; diphtheria, 55 cases; scarlet fever, 40 cases; typhoid fever, 320 cases; whooping cough, 63 cases; measles, 207 cases.

ZANESFIELD, LOGAN COUNTY.

Dr. C. M. Wanzer, health officer.

Population (estimated) 350.

Our local board of health was organized about one year ago, and is in good working order. We do not have stated meetings, for the health of the village has been perfect. The five deaths have all been of persons about 80 years of age, and their time was up.

The sanitary conditions seem perfectly satisfactory to everyone but the physicians, who are actually out of employment.

Infectious diseases reported during the year: Scarlet fever, 3 cases.

ZANESVILLE, MUSKINGUM COUNTY.

C. P. Sellers, M. D., health officer.

Population (estimated) 23,500.

The streets, alleys and yards are in a fair condition, the principal cause of complaint being lack of sewerage. The present system could be improved, but owing to "no funds" there will be little done at present towards any improvement or continuing what has been begun. All nuisances reported have been properly abated, with the exception of one, a private alley, and I think I will yet be able to get it properly cleaned without any trouble. The night soil is gathered in air-tight barrels, hauled to the country and plowed underground. The garbage is collected during the summer months by two wagons and hauled to the country, where it is disposed of. During the winter months the people take care of their own garbage. Next winter I hope to be able to make weekly collections of it by keeping one wagon all the time.

Part of the contagious diseases are promptly reported when found to exist, viz: smallpox, diphtheria, membranous croup and scarlet fever. The others, typhoid fever, whooping cough and measles are not well reported. The proper restrictive measures have been successfully enforced. We have had eleven cases of diphtheria this winter, the first since 1899. We seem to have it now under control. The other con-

tagious diseases have been no more prevalent than in other years. The superintendent of public schools reports 1,473 children and the parochial schools report 252 children attending their respective schools unvaccinated.

The local board of health has held four meetings during 1900. The board has brought no prosecutions, I am glad to say, during the year.

Amount expended, \$2,454.55.

Infectious diseases reported during the year: Diphtheria, 11 cases; membranous croup, 1 case; scarlet fever, 10 cases.

ZOAR, TUSCARAWAS COUNTY.

Charles J. Breymaier, health officer.

Population (estimated) 300.

Streets, alleys and yards in cleanly condition. No complaint for lack of sewerage or improper discharge of sewage. No nuisances to abate.

Contagious diseases have been reported properly since I have been in office and record of such is kept. Had no call for restrictive measures. No contagious diseases have been more prevalent than usual. None vaccinated.

The board of health held one meeting. No expenditures were necessary. No prosecutions brought by the board of health for violations of orders or health laws.

Infectious diseases reported during the year: Typhoid fever, 1 case.

ANNUAL REPORTS OF TOWNSHIP BOARDS OF HEALTH.

The following list of questions was sent to each township board of health:

1. How many meetings has the board held during the year?
2. Give number and character of nuisances abated by the board.
3. How many cases of contagious diseases were quarantined by the board?

Smallpox.....	Whooping cough.....
Diphtheria.....	Measles.....
Scarlet fever.....	Typhoid fever.....

4. Have attending physicians failed to report contagious diseases?
5. Has the board brought any prosecutions during the year?
6. If so, for what cause and with what result?
7. Give estimated number of persons in the township who were vaccinated during the year.
8. What amount of money was spent for board of health purposes?
9. What suggestions have you to offer for increasing the efficiency of township boards of health?

Reports were received from 997 township boards, or 72 percent. of the entire number. Lack of space forbids printing these reports in detail. The following summary will show that considerable sanitary work was done, though the fact that more than one-third of the boards of health for which reports were received, failed to meet is significant of a lack of interest. However, a large number of the township boards have appointed a health officer, who is the executive officer, and it does not necessarily follow that because a board failed to meet, nothing was done. The law requires these boards to meet at least once a year, and this law should be observed.

In 118 townships all or a part of the physicians practicing therein, failed to report cases of contagious diseases they were attending. No excuse can be offered for this neglect. The law requiring such reports is plain, and the physician who fails to observe it, and thus enable the health authorities to protect the community, is deserving of no sympathy, and should be prosecuted.

There were 3,546 cases of contagious diseases quarantined by the township boards. This is good work, and no doubt prevented many cases of sickness and many deaths that would have occurred had not precautionary measures been taken.

It is encouraging to note that the courts are upholding the health authorities in the enforcement of the health laws; all suits brought for their violation were decided in favor of the board of health.

ANSWER TO QUESTION 1.

Six hundred and four boards held meetings during the year.

ANSWER TO QUESTION 2.

Four hundred and thirty-six nuisances were abated by 139 different township boards.

ANSWER TO QUESTION 3.

Contagious diseases were reported in 491 of the 997 townships reporting. Thirty-three reported that they had been entirely free from contagious diseases. The total number of contagious diseases quarantined in the 491 townships reporting was: Smallpox, 910; diphtheria, 709; scarlet fever, 1,138; whooping cough, 118; measles, 407; typhoid fever, 264. In 118 townships, all or a part of the physicians failed to report.

ANSWER TO QUESTION 5.

Eight boards brought nine prosecutions for violation of the health laws. All of these suits were won.

ANSWER TO QUESTION 7.

In 155 townships there were reports of vaccination having been performed. The number of persons estimated to have been vaccinated in the 155 townships was 12,667.

ANSWER TO QUESTION 8.

In 374 townships reporting the expenditure of money, \$18,594.63 was spent for board of health purposes; an average of \$49.72.



ABSTRACT OF REPORTS
OF
DEATHS AND THEIR CAUSES
IN THE FOLLOWING
CITIES, VILLAGES AND TOWNSHIPS IN OHIO
FOR THE
Year Ending December 31, 1900.
(325)

[illegible]

*Not reported.

ABSTRACT OF THE REPORTS OF DEATHS, AND THEIR CAUSES, IN THE FOLLOWING CITIES OF OHIO DURING THE MONTH OF FEBRUARY, 1900.

Cities over 5,000 population. Census 1900.	Population	Total deaths, all causes.	Annual rate per 1,000.	Total under one year.	Total under five years and over one year.	Total zymotic diseases.	Croup and diphtheria.	Cholera infantum.	Cerebro-spinal meningitis.	Cholera morbus.	Diarrheal diseases.	Dysentery.	Malutal fevers.	Measles.	Scarlet fever.	Tonsillitis.	Typhoid fever.	Whooping cough.	Total constitutional diseases.	Cancer.	Phthisis Pulmonalis.	Total local diseases.	Apoplexia.	Bright's disease.	Bronchitis.	Convulsions.	Gastritis and peritonitis.	Heart disease.	Meningitis.	Pleurisy.	Pneumonia.	Total developmental diseases.	Total violence.	Premature and still births.		
*Akron	42,728	11	14.78	2	1	1														1	1	2	3									4	1	1		
Alliance	8,974	15	13.90	1	1															1	1	5	2										2	1	2	
Ashabula	12,949	9	10.89	2	1	1														1	1	3	2										4	2	1	
Bellefleur	9,912	9	10.89	2	1															1	1	3	2											1	2	
*Bellevue	6,610																			1	1	3	2											1	2	
*Bowling Green	5,667																			1	1	3	2											1	2	
Bucyrus	6,560	9	16.46			1	1													1	1	3	2											1	2	
Cambridge	8,241	9	13.11	2		2														1	1	3	2												1	2
*Canal Dover	5,422																			1	1	3	2												1	2
Canton	30,667	18	7.04	5	2	1														1	1	3	2												1	2
Chillicothe	12,976	15	13.10																	1	1	3	2												1	2
Cincinnati	325,902	438	16.44	64	60	53	12													1	1	3	2												1	2
Circleville	6,901	6	10.30	1																1	1	3	2												1	2
Cleveland	381,768	467	14.68	101	55	53	15	4	3											1	1	3	2												1	2
Columbus	125,500	145	13.86	23	16	19	4													1	1	3	2												1	2
Conneaut	7,133	8	13.46																	1	1	3	2												1	2
Coshocton	6,473	6	11.12	4																1	1	3	2												1	2
Dayton	85,333	192	14.45	12	3	3	2	4												1	1	3	2												1	2
Defiance	7,579	10	15.83																	1	1	3	2												1	2
Delaware	7,940	19	15.11																	1	1	3	2												1	2
East Liverpool	16,185	24	17.47	5	4	4	1													1	1	3	2												1	2
Elyria	8,701	10	13.65		1	1														1	1	3	2												1	2
Findlay	17,613	14	9.54	2		2														1	1	3	2												1	2
Fostoria	7,730	9	13.97	1																1	1	3	2												1	2
Fremont	8,439																			1	1	3	2												1	2
Galion	7,282	13	21.42			1														1	1	3	2												1	2
Gallopis	5,432	5	11.04	1																1	1	3	2												1	2
*Glenville	5,588																			1	1	3	2												1	2
Greenville	5,501	7	15.27																	1	1	3	2												1	2
Hamilton	23,914	38	19.68	9	2	2														1	1	3	2												1	2
Ironton	11,868	10	10.11		3															1	1	3	2												1	2
Kenton	6,832	8	14.01																	1	1	3	2												1	2
Kanawha	8,991	17	22.68	1	1		1													1	1	3	2												1	2

[illegible]

*Not reported.

Lima	21,723	33	18.23	8	7	2	1	1	1	1	5	12	1	2	2	2	1	6
Lorain	16,028	22	16.47	6	1	4	1	7	1	4	10	2	1	3	3	2	3	3
Mausheld	17,440	24	16.32	2	1			4	1	17	1	3	1	1	2	5	1	4
Maricetta	13,318	19	17.08	2	2			1	4	7	1	1	1	3	4	2	4	4
Marion	11,862	13	13.85					1	1	10	1	1	1	3				
Martin's Ferry	7,760							1	1	5	1	1	1	1	1	1	1	1
Massillon	8	8	8.01		1			4	2	9	2	1	1	1	1	2	1	1
Massillon	9,215	15	19.50	4	1	1		5										
Middletown	6,633							1										
Mt. Vernon	5,421							1										
Nelsonville	18,157	19	12.01		2	1	1	5	9	1	3	2	2	6	3	2		
Newark	5,969							1										
Newburg	6,213	5	9.66		1			1	3									
New Philadelphia	7,068							3	4	2								
Niles	7,074	7	11.88					2	1	5	1	1	1	1	1	1	1	1
Norwalk	6,180	6	11.11		1			2	1	1	1	1	1	1	1	1	1	1
Norwood	5,024	9	21.49		2			3	3	3	3	1	1	1	3	1	6	6
Painesville	12,172	12	11.83	1	4	4		10	9	13	1	2	1	2	2	1	6	6
Piqua	17,870	27	18.13	2	4	4		3	3	1	3	1	1	1	1	1	1	1
Portsmouth	5,359							3	3	1	2	8	4	1	1	1	1	1
St. Mary's	7,582	7	11.08		1	1		1	7									
Salem	19,664	19	11.60	6	2			1	8	1	6	4	5	1	3	4	14	3
Sandusky	5,688	4	8.44		1	4		1	2	1	1	1	1	1	1	1	1	1
Sidney	21,02	11	6	7	1			28	5	1	6	2	2	6	1	5	2	1
Springfield	38,253	67	21.02	11	6	7	1	1	1	1	1	1	1	1	1	1	1	1
Steubenville	14,349							1	1	1	1	1	1	1	1	1	1	1
Tiffin	10,989	9	9.87	28	18	36	8	4	1	3	1	28	14	65	1	2	15	5
Toledo	131,522	159	14.43	2	2			5	1	2	6	1	1	1	1	1	1	1
Troy	5,581	11	22.14		2			1	1	1	1	1	1	1	1	1	1	1
Urbana	6,808	11	19.40					1	1	1	1	1	1	1	1	1	1	1
Van Wert	6,122	11	26.16		3	1		2	2	2	6	1	1	1	1	1	1	1
Washington C. H.	8,629	14	19.70	2	1	1		1	1	1	1	1	1	1	1	1	1	1
Wellston	5,751	7	11.60	2	2			3	1	1	1	1	1	1	1	1	1	1
Wellsville	8,045	14	20.88	5	9	3	1	1	1	1	1	1	1	1	1	1	1	1
Wooster	6,136	5	9.78	2	1			1	4	3	5	2	1	1	1	1	1	1
Yonkers	23,755	12	23.75		1	1		1	2	2	1	1	1	1	1	1	1	1
Youngstown	41,565	17	23.46	1	5	3		1	2	2	5	1	1	1	1	1	1	1
Zanesville	23,538	34	17.33	13	12	1		8	9	7	43	21	1	21	3	5	1	1
Total	1,484,819	2,397	17.07	382	221	294	45	9	18	310	7	2	8	314	4	75	7	497

* Not reported.

[illegible]

Not reported,

Lima	21,723	30	16.57	5	2	9		3																								
Lorain	16,028	20	14.96	3	3	7		3																								
Mansfield	17,640	13	8.84	2	1	5																										
Marion	13,318	22	19.78	5																												
Martin's Ferry	11,892	8	8.09		2	1																										
Massillon	7,760	4	6.19																													
Middletown	11,944	5	5.02		2																											
Mt. Vernon	9,215	11	14.32	1																												
Nelsonville	6,633																															
Newark	18,137	17	11.23		1	3		1																								
Newburg	5,909																															
New Philadelphia	6,213	7	13.52		1																											
Niles	7,468																															
Norwalk	7,074	4	6.79			1		1																								
Norwood	6,480	3	5.56	1																												
Parisville	5,024	12	28.66	1		5																										
Piqua	12,172	17	16.76	2	1			1																								
Portsmouth	17,870	36	24.17	8	3	11																										
St. Mary's	5,339																															
Sal. m.	7,582	12	18.99		1																											
Sandusky	19,664	19	11.60	2	2			1																								
Sharon	5,688	4	8.44	1																												
Sharonville	38,233	45	13.85	4	4	5	3	1																								
Springfield	11,349																															
Union	10,989	12	13.19		1																											
Unionville	14,822	122	12.02	34	13	19	6																									
Wadsworth	3,881																															
Wadsworth	6,838	11	19.49		1																											
Wadsworth	6,422	11	29.55		2																											
Wadsworth	8,529	7	9.85	2	1																											
Wadsworth	5,751	7	14.60																													
Wadsworth	8,015	12	17.52	1	1	2		1																								
Wadsworth	6,433	9	17.69	1	2																											
Wadsworth	6,063	11	21.77		3	1																										
Wadsworth	8																															
Wadsworth	11,885	52	13.91	9	9	5	1																									
Wadsworth	23,388	19	9.65	3	1																											
Wadsworth	1,861,618	2,498	11.93	337	139	243	27	10	11	5	8	4	5	15	18	12	18	12	18	12	18	12	18	12	18	12	18	12	18	12	18	

• Not reported.

[illegible]

* Not reported.

[illegible]

*Not reported.

Lima	21,723	37	20.44	15	1	16	8	2	1	3	1	4	1	3	3	1	2	1	1	2	1	5	2	3	6	4
Loran	16,628	24	17.37	9	5	2	2	1	1	1	7	3	1	3	1	7	3	1	1	1	1	1	5	2	3	1
Mansfield	17,640	5	3.46	1	2	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	
Marietta	13,348	12	10.73	3	1	7	1	1	1	1	2	1	3	1	2	1	3	1	1	1	1	1	1	1	1	
Marion	11,802	18	18.20	1	5	2	1	1	1	1	1	1	1	1	11	1	1	1	1	2	1	1	1	1	1	
Martin's Ferry	7,760	8	8.04	5	4	3	1	1	1	1	3	1	1	1	3	1	1	1	1	1	1	1	1	1	1	
Massillon	11,944	8	8.04	5	4	3	1	1	1	1	3	1	1	1	3	1	1	1	1	1	1	1	1	1	1	
Massillon	9,215	6	7.80	2	1	1	1	1	1	1	3	1	1	1	3	1	1	1	1	1	1	1	1	1	1	
Middletown	6,633	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	
Mt. Vernon	5,421	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	
Nelsonville	18,157	32	21.15	5	1	11	1	4	1	4	2	2	2	2	6	2	2	2	2	2	2	6	1	1	1	
Newark	5,909	8	15.46	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	
Newburg	6,213	8	15.46	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	
New Philadelphia	7,468	2	3.39	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	
Niles	7,074	2	3.39	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	
Norwalk	6,480	8	14.80	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	
Norwood	5,024	8	19.11	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	
Painesville	12,172	15	14.79	3	1	2	1	1	1	1	2	2	2	2	7	1	1	1	1	2	1	1	2	1	1	
Piqua	17,870	10	6.71	1	1	2	1	1	1	2	2	2	2	2	1	5	1	1	1	1	1	1	1	1	1	
Portsmouth	5,359	12	18.99	1	2	7	1	1	1	1	5	1	1	1	5	1	1	1	1	1	1	1	1	1	1	
St. Marys	7,582	21	12.82	6	1	5	5	1	1	3	6	1	6	1	2	10	3	1	1	1	1	1	1	1	1	
Salem	19,664	21	18.99	3	1	6	2	1	1	2	3	2	2	1	3	3	2	1	1	1	1	1	1	1	1	
Sandusky	5,688	9	18.99	3	1	6	2	1	1	1	5	1	6	1	5	21	5	4	1	1	1	1	1	1	1	
Sidney	28,253	30	11.30	4	2	5	3	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	
Springfield	14,349	10	10.92	2	3	3	2	1	1	1	4	2	28	9	13	63	1	3	1	1	1	1	1	1	1	
Steubenville	10,959	10	10.92	46	33	58	15	16	16	1	1	1	1	1	4	1	3	1	1	1	9	4	12	3	8	
Tiffin	131,822	194	17.62	2	3	3	2	2	16	1	1	1	1	1	2	28	9	13	63	1	3	1	9	4	12	
Toledo	10,959	10	10.92	46	33	58	15	16	16	1	1	1	1	1	4	2	28	9	13	63	1	3	1	9	4	
Tolledo	10,959	10	10.92	46	33	58	15	16	16	1	1	1	1	1	4	2	28	9	13	63	1	3	1	9	4	
Troy	5,881	5	5.81	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	
Urbana	6,808	5	8.81	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	
Van Wert	37,37	20	37.37	1	3	1	1	1	1	1	3	1	1	1	1	1	1	1	1	1	1	1	1	1	1	
Warren	8,629	9	12.66	1	3	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	
Washington C. H.	5,721	6	12.52	1	3	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	
Wellston	8,945	3	5.57	2	2	2	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	
Wellsville	6,136	7	13.85	1	1	1	1	1	1	1	3	1	3	1	2	3	2	1	1	1	1	1	1	1	1	
Wooster	6,963	8	11.04	1	3	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	
Xenia	8,696	39	10.43	11	3	6	2	2	2	2	4	2	4	2	2	19	1	1	1	1	1	1	1	1	1	
Youngstown	44,885	39	10.43	11	3	6	2	2	2	2	4	2	4	2	2	19	1	1	1	1	1	1	1	1	1	
Zanesville	23,538	21	10.71	4	3	9	4	4	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	
Total	1,570,993	1,879	13.43	393	193	416	47	130	6	130	36	2	1	6	70	10	292	68	133	833	59	45	16	66	67	147

*Not reported.

[illegible]

*Not reported.

[illegible]

Not reported.

Lima	21,723	396	18,23	76	29	99	6	27	...	...	2	1	5	1	3	2	2	17	4	57	15	42	149	9	6	2	6	1	43	10	...	40	57	34	37
Lorain	16,028	250	11,73	48	23	47	9	12	...	...	2	5	...	...	3	...	...	...	...	13	3	30	100	73	8	6	1	9	13	3	...	17	29	26	27
Manshfield	17,040	185	14,17	15	17	47	10	...	...	...	2	6	...	...	4	...	...	...	...	38	8	20	100	73	8	6	1	9	13	3	...	15	15	20	20
Marietta	13,348	192	14,38	38	15	30	5	5	...	...	2	3	2	1	2	7	...	...	...	39	8	22	82	6	16	3	6	10	15	7	...	15	15	20	20
Marion	11,862	152	12,81	25	3	21	1	4	...	...	2	3	2	1	2	7	...	...	...	39	8	22	82	6	16	3	6	10	15	7	...	15	15	20	20
Martins Ferry	7,760	169	14,05	24	4	39	11	7	...	...	2	3	2	1	2	7	...	...	...	20	4	15	92	7	4	5	1	5	17	...	...	19	5	14	13
Massillon	11,944	124	10,38	22	4	32	3	10	...	...	2	3	2	1	2	7	...	...	...	20	4	15	92	7	4	5	1	5	17	...	...	19	5	14	13
Middletown	9,213	163	11,18	16	7	12	1	2	...	...	1	3	3	...	...	9	...	...	...	20	4	15	92	7	4	5	1	5	17	...	...	19	5	14	13
Mt. Vernon	6,653	71	10,70	6	5	11	1	2	...	...	1	3	3	...	...	9	...	...	...	20	4	15	92	7	4	5	1	5	17	...	...	19	5	14	13
Nelsonville	5,421	92	16,37	15	8	20	1	7	...	...	1	3	3	...	...	9	...	...	...	20	4	15	92	7	4	5	1	5	17	...	...	19	5	14	13
Newark	18,157	280	15,42	45	18	48	3	18	...	...	1	1	6	2	...	3	8	3	56	7	31	96	6	8	1	5	6	23	6	...	10	16	6	24	
Newburg	5,909	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
New Philadelphia	6,213	71	11,43	5	2	13	1	2	...	...	1	1	1	...	...	...	...	...	...	16	6	3	34	3	2	3	...	2	15	4	...	3	1	7	4
Niles	7,468	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
Norwalk	7,074	51	7,21	4	...	9	...	...	...	...	...	...	...	...	...	...	...	...	...	12	4	8	48	2	4	2	3	3	12	3	...	5	...	1	5
Norwood	6,480	74	11,42	16	6	8	2	...	...	...	...	...	...	...	...	...	...	...	...	12	4	8	48	2	4	2	3	3	12	3	...	5	...	1	5
Painesville	5,024	90	17,91	9	2	19	...	1	1	1	19	4	8	39	6	7	1	2	2	7	3	...	5	...	4	9	3
Piqua	12,172	159	13,06	25	13	25	2	10	...	...	2	2	...	...	...	...	...	...	...	38	9	24	77	7	9	...	2	2	14	8	...	12	15	4	...
Portsmouth	17,870	287	16,06	53	31	68	2	3	3	1	1	1	70	7	44	133	2	6	12	9	4	24	6	...	1	25	4	12	32
St. Marys	5,359	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
Salem	7,582	101	13,32	4	5	21	10	1	...	...	1	2	...	...	...	...	...	...	...	33	2	8	40	7	3	3	4	10	15	...	...	4	...	7	6
Sandusky	19,064	227	11,54	49	14	42	9	17	...	...	1	2	...	...	...	...	...	...	...	58	10	18	88	8	4	3	19	11	9	...	...	15	25	14	22
Sidney	5,688	67	11,78	11	7	17	...	8	...	...	1	4	...	...	...	...	...	...	...	6	1	4	41	2	4	2	1	2	8	1	...	7	...	3	2
Springfield	38,253	625	13,72	65	36	66	10	14	...	...	5	1	5	1	...	2	2	17	3	79	18	59	302	43	35	20	19	14	41	13	...	49	94	24	40
Steubenville	14,319	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
Tiffin	10,989	138	12,56	29	12	21	8	2	...	...	2	...	...	...	...	...	...	...	...	28	8	17	65	7	4	2	1	4	12	3	...	12	17	7	6
Toledo	131,822	1,847	14,01	396	234	410	106	63	...	...	77	11	6	5	15	18	...	...	...	278	65	148	700	64	57	30	74	37	123	55	2	158	284	108	193
Troy	5,881	99	15,29	...	10	7	...	1	...	...	2	1	...	...	...	...	...	...	...	38	8	23	24	9	...	...	...	...	...	...	...	...	...	...
Urbana	6,898	93	13,66	7	8	14	...	...	...	...	1	1	1	1	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
Van Wert	6,422	137	21,33	...	34	...	...	...	...	...	1	1	1	1	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
Warren	8,529	137	16,06	...	14	12	36	5	4	...	3	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
Washington C. H.	5,751	103	17,91	12	13	26	3	5	...	...	3	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
Wellston	8,045	59	7,33	16	7	12	...	...	...	...	2	1	1	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
Wellsville	6,136	106	17,27	24	19	45	18	3	...	...	2	1	1	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
Wooster	6,963	114	18,80	2	...	16	7	1	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
Yonkers	8,096	146	16,78	17	9	22	3	1	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
Youngstown	44,885	603	13,43	132	57	131	6	30	...	...	6	4	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
Zanesville	25,538	311	13,21	35	13	64	4	9	...	...	1	2	7	2	1	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
Total	1,757,950	25,578	14,55	474	2917	4331	658	725	135	53	2	1	77	46	701	18	831	34	4543	797	9224	12	847	723	615	863	667	3041	745	33	2278	2395	1337	1	840	

* Not reported. Statistics taken from annual reports.

[illegible]

ABSTRACT OF THE REPORTS OF DEATHS, AND THEIR CAUSES, IN THE FOLLOWING VILLAGES OF OHIO DURING THE YEAR 1900.

Villages—Continued.	Population.	Total deaths, all causes.	Annual rate per 1,000.	Total under one year.	Total under five years and over one year.	Total zymotic diseases.	Croup and diphtheria.	Cholera infantum.	Cerebro-spinal meningitis.	Cholera morbus.	Diarrheal diseases.	Dysentery.	Malarial fevers.	Measles.	Puerperal fever.	Scarlet fever.	Tonsillitis.	Typhoid fever.	Whooping cough.	Cancer.	Phthisis Pulmonalis.	Total local diseases.	Apoplexia.	Bright's disease.	Bronchitis.	Convulsions.	Gastritis and peritonitis.	Heart disease.	Meningitis.	Pleurisy.	Pneumonia.	Total developmental diseases.	Total violence.	Premature and still births.	
Geneva	2,342	46	19.61	1	1	1	1	1	1	1	1	1	1	1	1	1	1	3	16	4	5	19	1	1	1	2	1	1	5	2	1	5	1	1	
Germantown	1,702	24	14.10	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	100	8	3	4	5	19	1	1	1	1	1	1	1	1	1	1	
Glard	2,630	36	13.69	4	2	2	2	2	1	1	1	1	1	1	1	1	1	1	6	1	2	3	4	5	19	1	1	1	1	1	1	1	1	1	
Glendale	1,545	25	16.18	7	1	1	1	1	1	1	1	1	1	1	1	1	1	1	2	1	1	3	10	1	1	1	1	1	1	1	1	1	1	1	
Grafton	1,098	9	8.20	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	
Grand Rapids	549	12	21.86	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	4	1	2	1	5	1	1	1	1	1	1	1	1	1	1	
Grand River	332	1	3.03	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	
Green Camp	369	6	16.26	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	
Green Spring	816	14	17.16	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	
Grove City	656	4	6.09	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	
Hanging Rock	665	12	18.05	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	
Hartod	370	4	10.81	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	
Hartwell	1,833	16	8.73	1	2	1	1	1	1	1	1	1	1	1	1	1	1	1	1	4	2	2	1	1	1	1	1	1	1	1	1	1	1	1	
Haskins	449	4	8.91	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	
Haviland	186	1	5.38	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	
Hicksville	2,520	25	9.92	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	
Hillshoro	4,535	54	11.90	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	2	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	
Hollansburg	275	6	21.82	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	15	1	10	1	1	1	1	1	1	1	1	1	1	1	1	
Holmesville	304	2	6.58	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	
Hudson	983	13	13.23	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	
Huntsville	1,408	5	12.25	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	2	1	2	1	1	1	1	1	1	1	1	1	1	1	1	
Huron	1,708	4	2.34	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	
Hyde Park	1,691	5	2.96	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	
Jackson	4,672	60	12.84	4	7	23	4	1	6	1	1	1	1	1	1	1	1	3	8	1	1	3	1	1	1	1	1	1	1	1	1	1	1	1	
Jackson Center	644	12	18.63	2	2	3	3	3	3	3	3	3	3	3	3	3	3	3	2	2	1	1	20	3	1	4	1	1	1	1	1	1	1	1	
Jenera	237	4	16.88	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	
Jewett	743	10	13.47	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	
Junction City	1,443	5	11.29	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	
Kelley's Island	1,174	15	12.77	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	
Kent	4,541	59	13.00	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	
Lakewood	3,355	25	7.45	7	3	6	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Larue	397	16	16.05	1	1	5	5	5	5	5	5	5	5	5	5	5	5	5	1	1	1	2	7	2	1	2	1	1	1	1	1	1	1	1	1

[illegible]

[illegible]

[illegible]

[illegible]

[illegible]

ABSTRACT OF THE REPORTS OF DEATHS, AND THEIR CAUSES, IN THE FOLLOWING TOWNSHIPS OF OHIO DURING THE YEAR 1900.

Townships—Con.	Population.	Total deaths, all causes.	Annual rate per 1,000.	Total under one year.	Total under five years and over one year.	Total zymotic diseases.	Croup and diphtheria.	Cholera infantum.	Cerebro-spinal meningitis.	Diarrhoeal diseases.	Dysentery.	Malarial fevers.	Measles.	Puerperal fever.	Tonsillitis.	Typhoid fever.	Whooping cough.	Total constitutional diseases.	Cancer.	Phthisis Pulmonalis.	Total local diseases.	Apoplexia.	Bright's disease.	Bronchitis.	Convulsions.	Gastritis and peritonitis.	Heart disease.	Meningitis.	Pleurisy.	Pneumonia.	Total developmental diseases.	Total violence.	Premature and still births.
Preble—	978	..	3.08	..	..	2	..	..	..	..	..	..	..	..	..	..	..	..	..	..	1	1	..	..	..	..	..	..	..	..	..	..	..
Dixon	1,351	7	5.18	..	..	1	..	..	..	..	..	..	..	..	..	..	..	..	..	..	4	1	..	..	..	..	..	..	..	..	..	..	..
Gratis	2,218	5	2.26	..	..	1	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Harrison	1,257	1	..	..	..	..	1	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Israel	1,255	5	3.99	..	..	3	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Jackson	1,126	28	24.87	1	1	2	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Jefferson	918	12	13.07	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Somers	1,479	2	1.36	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Twin	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Putnam—	1,211	5	4.13	..	..	5	5	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Greensburg	1,465	14	9.55	2	..	5	..	2	1	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Jennings	1,342	11	8.20	..	10	7	3	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Monterey	1,366	..	..	..	..	1	1	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Perry	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Richland—	978	4	4.09	..	..	1	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Bloomington	730	12	16.46	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Cass	841	5	5.95	..	..	2	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Jackson	800	7	8.75	1	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Miflin	1,224	8	6.54	..	..	1	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Monroe	1,373	6	4.37	1	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Springfield	368	3	3.30	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Weller	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Ross—	2,240	27	12.05	3	5	5	..	1	1	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Concord	965	13	14.36	1	2	5	..	3	1	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Dorfield	356	2	2.14	..	..	2	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Jefferson	1,606	13	8.13	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Liberty	1,068	8	7.50	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Paint	1,073	6	3.04	1	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Seloto	2,317	4	1.30	..	..	3	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Union	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..

Townships—Con.

[illegible]

[illegible][illegible]

ABSTRACT OF THE REPORTS OF DEATHS, AND THEIR CAUSES, IN OHIO, DURING THE YEAR 1900.

Census of 1900.	Population.	Total Deaths.	Annual rate per 1,000.	Total under one year.	Total under five years and over one year.	Total Zymotic diseases.	Croup and Diphtheria.	Cholera Infantum.	Cerebro Spinal-Meningitis.	Cholera Morbus.	Diarrheal diseases.	Dysentery.	Malarial Fever.	Measles.	Puerperal Fever.	Scarlet Fever.	Tonsillitis.	Typhoid Fever.	Whooping Cough.	Total Constitutional Dis- eases.	Cancer	Phthisis Pulmonalis.	Total Local Diseases.	Apoplexy.	Bright's Disease.	Bronchitis.	Convulsions.	Gastritis and Peritonitis.	Heart Disease.	Meningitis.	Pleurisy.	Pneumonia.	Total Developmental Dis- eases.	Total Violence.	Premature Births.	and Still
Cities over 5,000 population	1,757,950	25,578	14.55	4741	2217	4331	658	725	135	53	226	187	77	46	70	143	18	83	134	4543	797	2229	12266	847	723	615	863	667	2041	745	33	2278	2395	1337	1840	
Villages (202)	342,263	4,126	12.05	364	195	858	108	153	72	12	30	44	11	7	19	21	12	167	35	771	154	527	1777	167	137	39	81	105	424	70	14	326	139	194	212	
Townships (503).	660,143	4,592	6.95	255	165	110	217	153	71	15	22	61	25	13	12	63	12	203	35	914	188	485	1869	193	165	33	52	89	433	45	10	335	171	144	203	
Total	2,760,456	34,296	12.46	5380	2577	6299	983	1631	278	80	278	292	113	68	101	227	42	1291	204	6228	1139	3241	15112	1207	1025	687	996	861	2898	869	57	2383	2705	1675	2255	

SUMMARY OF MORTALITY REPORTS.

The total number of deaths reported from all causes — excluding premature and still-births — by the cities, villages and townships represented in the foregoing tables was 34,296. The average population of the cities, villages and townships represented (Census 1900) was 2,760,656, which is equal to an annual death rate of 12.66 per thousand living population represented.

The deaths in 2,760,720 living population (estimated) in 1899 were 32,309, equal to an annual death rate of 11.70 per thousand; while in 1898 the total number of deaths reported in 2,705,126 population (estimated) was 29,346, equal to a mortality rate of 10.85 per thousand.

DEATHS OF CHILDREN UNDER FIVE YEARS OF AGE.

The number of deaths reported of children under five years of age (premature and still-born excluded) was 7,937, which is equal to 20.29 per cent. of the deaths from all causes, and a death rate of 2.5 per thousand population represented. The death rate of children under five the preceding year was 2.6 per thousand population represented.

ZYMOTIC DISEASES.

The total number of deaths reported from zymotic diseases was 6,299, which is equal to 18.4 per cent. of the deaths reported from all causes, and an annual rate of 2.3 per thousand of the population represented.

The number of deaths reported the preceding year from zymotic diseases was 6,127, equal to a death rate of 2.2 per thousand population represented.

CROUP AND DIPHTHERIA.

The total number of deaths reported from croup and diphtheria was 983, which is equal to 2.9 per cent. of the deaths reported from all causes, and a death rate of .35 per thousand of the population represented.

The number of deaths reported the preceding year from these causes was 854, equal to a mortality rate of .3 per thousand of the population represented.

CHOLERA INFANTUM, CHOLERA MORBUS AND DIARRHOEA.

The total number of deaths reported from cholera infantum, cholera morbus and diarrhoea was 1,389, which is equal to 4.02 per cent. of the deaths reported from all causes, and a mortality rate of .5 per thousand population represented.

The number of deaths reported the preceding year from these causes was 1,210, which is equal to a mortality rate of .4 per thousand of the population represented.

MEASLES, SCARLET FEVER AND WHOOPING COUGH.

The total number of deaths reported from measles, scarlet fever and whooping cough was 499, which is equal to 1.5 per cent. of the total number of deaths reported from all causes, and a mortality rate of .18 per thousand of the population represented.

The total number of deaths reported from these diseases during the preceding year was 522, equal to a mortality rate of .19 per thousand population represented.

TYPHOID FEVER.

The total number of deaths reported from typhoid fever was 1,291, which is equal to 3.8 per cent. of the total number reported from all causes, and a mortality rate of .47 per thousand population represented.

The number of deaths reported from this cause the preceding year was 1,072, equal to a mortality rate of .39 per thousand living population represented.

CONSTITUTIONAL DISEASES.

The total number of deaths reported from constitutional diseases was 6,228, which is equal to 18.16 per cent. of the deaths reported from all causes, and a mortality rate of 2.2 per thousand population represented.

The number of deaths reported from constitutional diseases the preceding year was 6,101, equal to a mortality rate of 2.2 per thousand population represented.

CANCER.

The total number of deaths reported from cancer was 1,139, which is equal to 3.3 per cent. of the deaths reported from all causes, and a mortality rate of .4 per thousand population represented.

The number of deaths reported from this cause the preceding year was 1,131, equal to a mortality rate of .41 per thousand population represented.

CONSUMPTION.

The total number of deaths reported from consumption was 3,241, which is equal to 9.5 per cent. of the deaths reported from all causes, and a mortality rate of 1.18 per thousand population represented.

The number of deaths reported from this cause the preceding year was 3,148, equal to a mortality rate of 1.14 per thousand population represented.

LOCAL DISEASES.

The total number of deaths reported from all local diseases was 15,912, which is equal to 45.8 per cent. of the deaths reported from all causes, and a mortality rate of 5.8 per thousand population represented.

The number of deaths reported from all local diseases the preceding year was 14,464, equal to a mortality rate of 5.2 per thousand population represented.

BRONCHITIS, PLEURISY AND PNEUMONIA.

The total number of deaths reported from bronchitis, pleurisy and pneumonia was 3,682, which is equal to 10.4 per cent. of the deaths reported from all causes, and a mortality rate of 1.4 per thousand of the population represented.

In the preceding year there were 3,234 deaths reported from these causes, equal to a mortality rate of 1.2 per thousand population represented.

CONVULSIONS AND MENINGITIS.

The total number of deaths reported from convulsions and meningitis was 1,856, which is equal to 5.4 per cent. of the deaths reported from all causes, and a mortality rate of .67 per thousand population represented.

The number of deaths reported from these diseases the preceding year was 1,854, equal to a mortality rate of .67 per thousand population represented.

DEVELOPMENTAL DISEASES.

The total number of deaths from developmental diseases reported (excluding premature and still-births) was 2,705, which is equal to 7.9 per cent. of the deaths reported from all causes, and a mortality rate of 9.8 per thousand population represented.

During the preceding year there were 2,528 deaths reported from developmental diseases, equal to a mortality rate of .92 per thousand population represented.

VIOLENCE.

The total number of deaths reported from violence was 1,675, which is equal to 4.9 per cent of the deaths reported from all causes, and a mortality rate of .6 per thousand population represented.

During the preceding year there were 1,651 deaths reported from violence, equal to a mortality rate of .6 per thousand population represented.

PREMATURE AND STILL-BIRTHS.

The total number of premature and still-births reported was 2,255, which is equal to 6.6 per cent. of the deaths reported from all causes, and a rate of .82 per thousand population represented.

During the preceding year there were 2,265 premature and still-births reported, equal to a rate of .79 per thousand population represented.



APPENDIX.

FOURTH REPORT OF AN
INVESTIGATION

OF

THE RIVERS OF OHIO

AS SOURCES OF PUBLIC
WATER SUPPLIES.

BY THE OHIO STATE BOARD OF HEALTH.

1901.

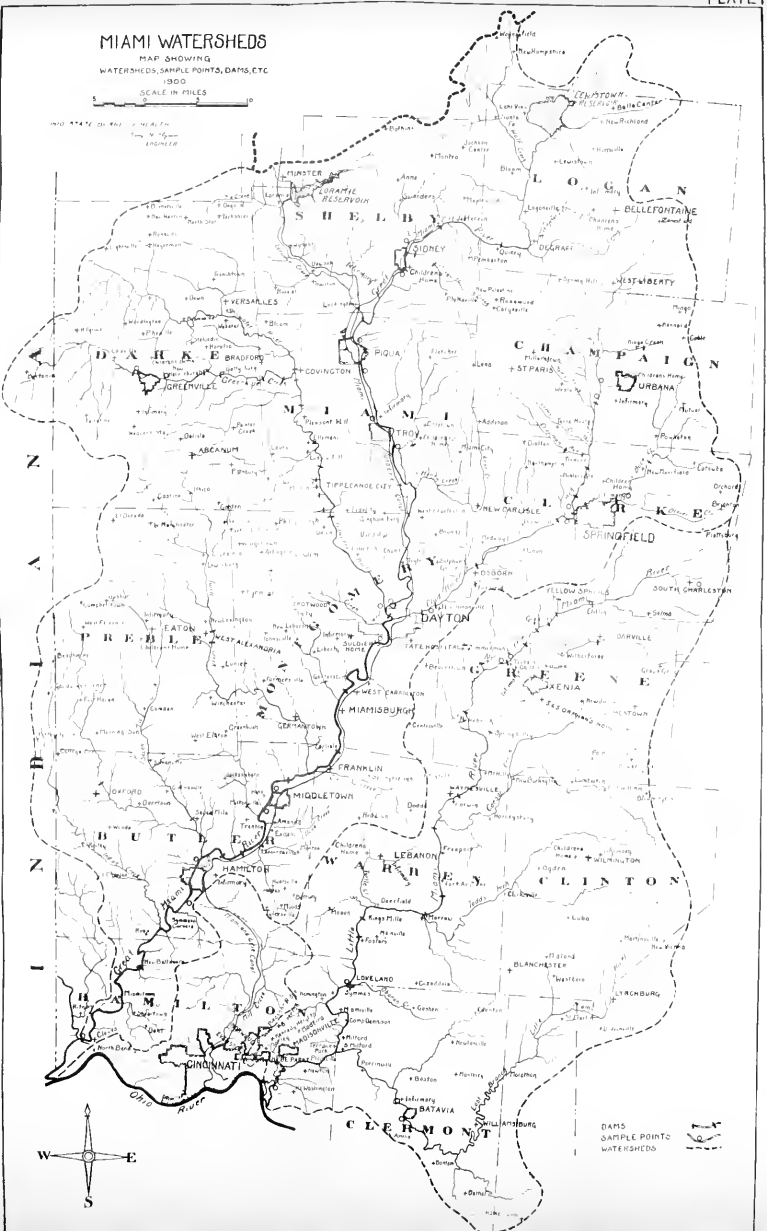
(379)

MIAMI WATERSHEDS

MAP SHOWING
WATERSHEDS, SAMPLE POINTS, DAMS, ETC.
1900

SCALE IN MILES

UNITED STATES GEOLOGICAL SURVEY
W. M. G. ENGINEER



DAMS
SAMPLE POINTS
WATERSHEDS

FOURTH REPORT UPON THE EXAMINATION OF SOURCES OF PUBLIC WATER SUPPLIES.

This special report deals with an examination of the two Miami rivers, in continuation of an investigation of the condition of sources of public water supplies begun in 1897. This completes the investigation for all the interior streams. Another year will be required for a study of the water supplies of the Ohio River and Lake Erie, which will finish the work.

The two Miamis drain the most elevated, and, in some aspects, the most beautiful portion of the state. With a total drainage area of 6,956 square miles, of which 5,601 square miles are in Ohio, they both discharge their waters into the Ohio River near Cincinnati.

The population of the two watersheds — census of 1900 — is 641,657, or 92 persons per square mile. Excluding that part of the watershed of the Great Miami lying in Indiana and the population upon it, the average population is a little higher—100 persons per square mile of watershed. This is slightly below the average for the state.

Batavia and Piqua are the only communities within this territory that depend entirely upon these rivers (their tributaries) for a water supply. Batavia has installed a mechanical filter to purify its supply, and is reasonably free from danger from polluted water. Piqua obtains water from a feeder for the Miami and Erie canal. The water is not considered fit for domestic use, and is but little, if at all, used for that purpose.

Blanchester makes up a deficiency in its well supply in using the impounded waters of a small creek. Both the well and surface waters are of inferior quality.

Springfield has ordinarily a ground water supply, but in dry years has resorted to Buck Creek for an additional supply. The creek water is not suitable for domestic use, and Springfield must soon make suitable provision for increasing its present insufficient supply.

Thirty cities and villages within the territory under consideration have public water supplies. The combined population so furnished is 242,762, which is 44 per cent. of the entire population, and 91 per cent. of the urban population, as here classified. There are six villages of less than 1,000 inhabitants that have water works, and 18 urban towns (over 1,000 population) without water works and still dependent upon private wells. Miamisburg and Wilmington, each with nearly 4,000 population, are in this list. More than half of the water works in this territory have been installed since 1890. The 25 plants that have been

completed cost \$4,352,805, with a per capita cost varying from 8 to 32 dollars. The average daily supply of water for 20 plants for which information could be obtained was 67 gallons per capita of the total population, and 116 gallons per consumer. In the engineer's report may be found some interesting data in regard to rates charged for water by the different municipalities and companies operating water works. A detailed report is also given of the various sources of pollution of the rivers under consideration. It will be noted that there are a considerable number of strawboard works and paper mills discharging their wastes into these streams. This has already caused a nuisance in some places, and started litigation for the abatement thereof.

Of the 29 cities and villages having water works 15, including Hyde Park, have more or less extensive sewerage systems. In all instances the sewage is discharged to streams without purification. The estimated number of closet connections to these sewers is 4,197, and about 14 per cent. of the total population are using the sewers. About 50 per cent. of the population having access to the sewers make use of them.

While no public water supplies in Ohio, except that of Cincinnati, are affected to much extent by the sewage discharged into the Miami rivers, more or less nuisance has already been caused in thirteen different places by sewage pollution. Many of these communities must face the problem of sewage purification in the near future. The city of Xenia is to be congratulated for having provided for sewage purification works to be constructed in conjunction with a new system of sewers.

A source of pollution of streams too frequently lost sight of or but lightly considered, is the sewage from public institutions. Within the watersheds of the two Miamis there is a population of 531 in Childrens' Homes, 1,509 in County Infirmarys and 8,151 in other public institutions, including the Soldiers' Home at Dayton and the Ohio Soldiers' and Sailors' Orphans' Home at Xenia. This gives a total population of 10,191, nearly all using sewerred closets that discharge into streams, so that the public institutions are responsible for nearly one-third as much sewage as are all the cities and villages on both watersheds.

As pointed out in the engineer's report, "In not a single instance does it seem necessary to pollute the streams with sewage from these institutions. Everything is favorable to the installation of some method of purification; the sewerage is small in amount, usually in a concentrated form; it is collected in one outfall sewer; in nearly every case land is plentiful, and usually labor can be had at small or no extra expense." The commissioners of Montgomery county deserve credit for having recently constructed a very satisfactory system of sewage disposal for the infirmiry of that county.

Supplementary to the survey of the two watersheds to determine the origin and nature of the various pollutions of the rivers, monthly chemical and bacteriological examinations of samples of water taken from the

rivers at twenty-nine different places were made for a period of eight months. A detailed report of the findings may be found in the report of the chemist and bacteriologist. These results agree very well, as regards the character of these waters, with the conclusions to be reached from a study of the engineer's report. Neither river is grossly polluted, except some of their small tributaries, but neither in any part of its course would furnish water suitable for domestic purposes without purification.

The Little Miami River is objectionable in appearance, has a noticeable odor at all times, and carries considerable sediment. It is now receiving in many places the full amount of decomposable matters that can be harmlessly disposed of by natural processes.

The Great Miami River also carries considerable sediment, and clear waters are rarely to be found. The main stream is still able to maintain a sufficient degree of purification to prevent nuisances from bad odors, but in addition to large quantities of vegetable matters it is called upon to receive and purify, the sewage of towns and wastes of factories poured into it which have already reached proportions that make it impossible for it to regain at any point the degree of purity possessed by its head waters.

It would be a wise policy for the communities contributing to the pollution of these streams to give early consideration to the question of measures to preserve them from further damage.

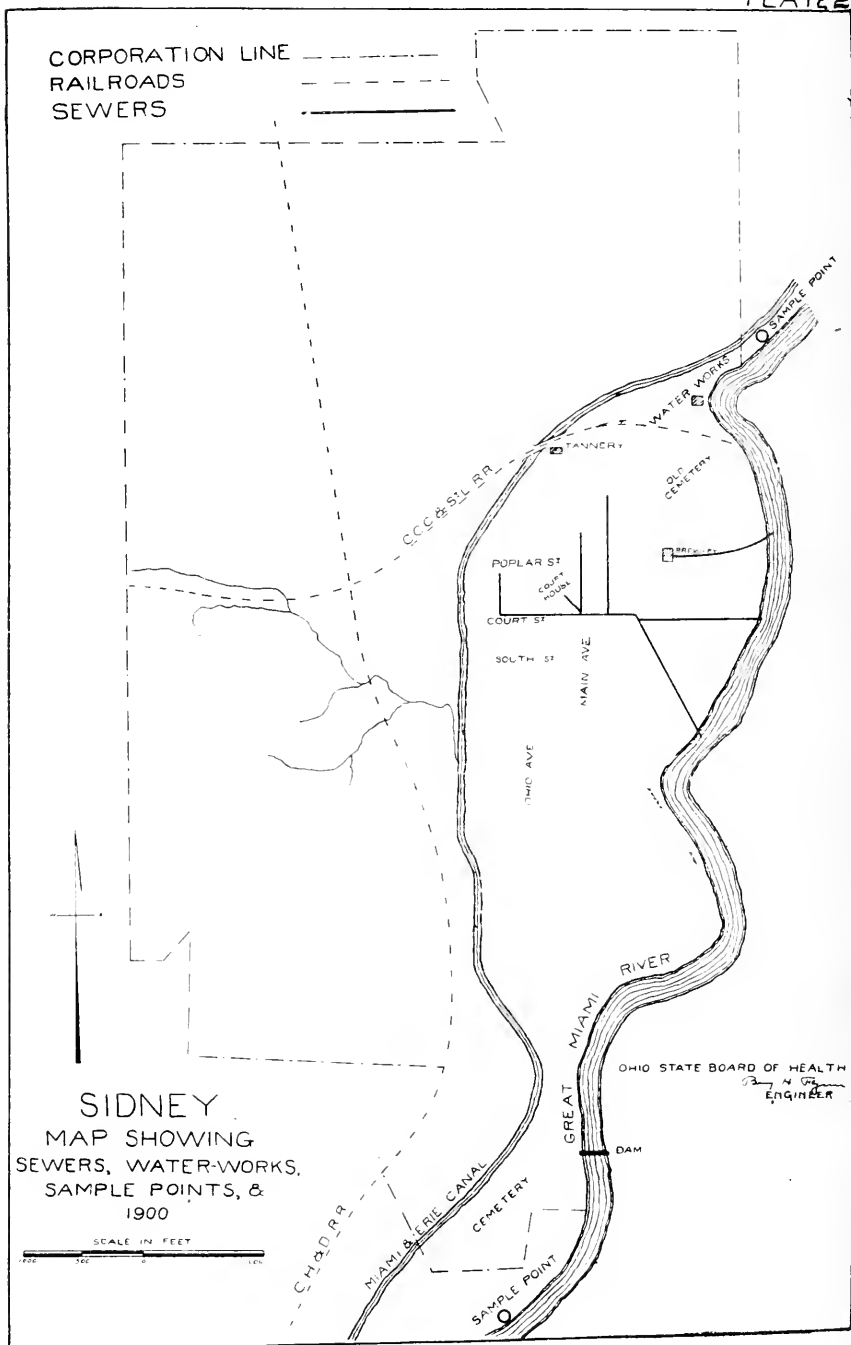


PLATE 3

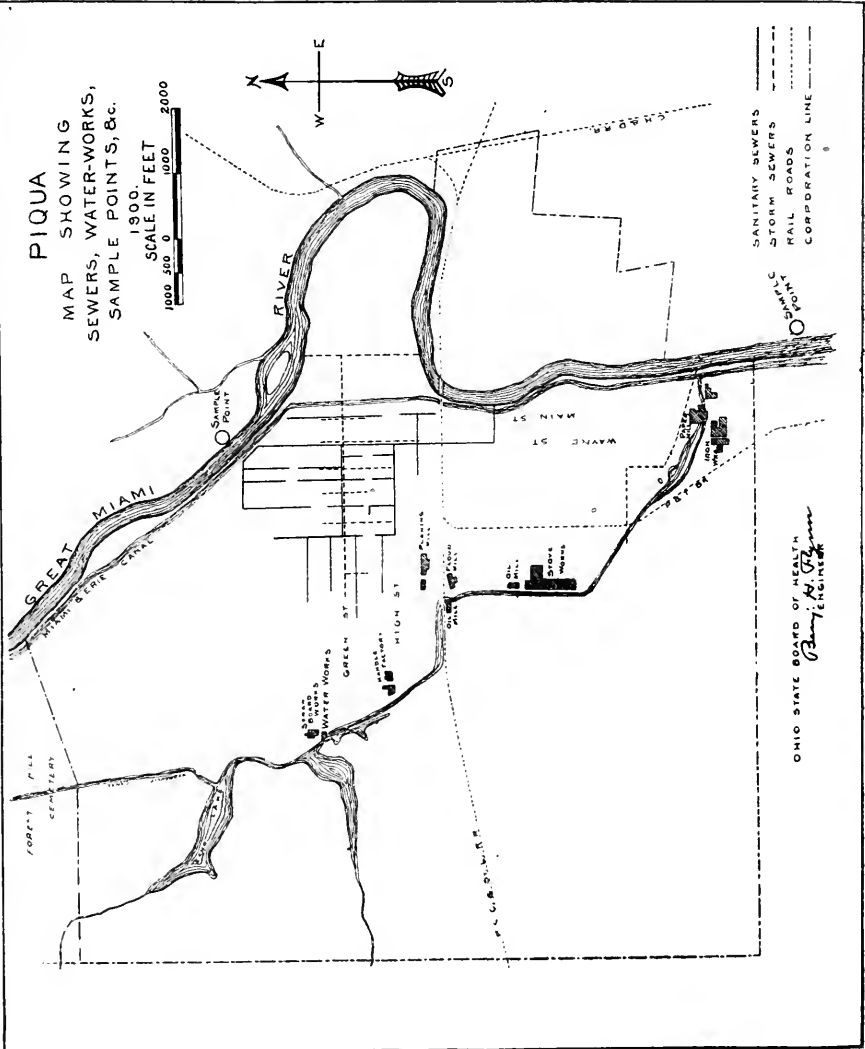


PLATE 4

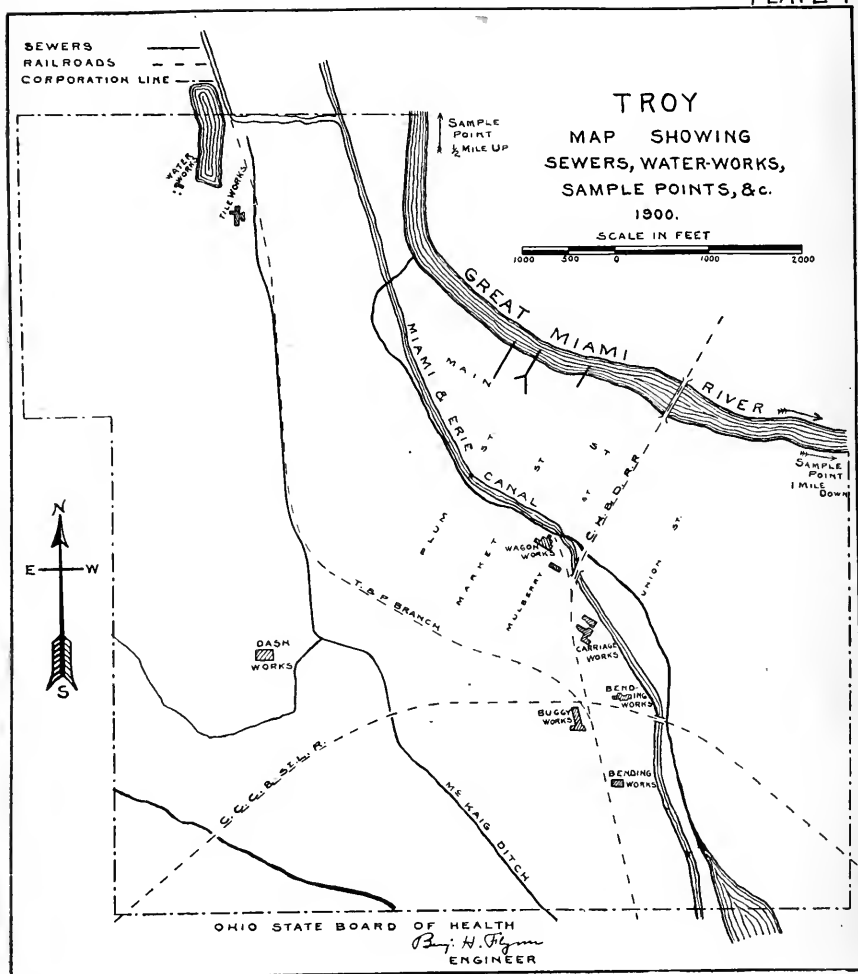


PLATE 5

GREENVILLE

MAP SHOWING
SEWERS, WATER-WORKS,
SAMPLE POINTS, &c
1900.

OHIO STATE BOARD OF HEALTH
Benjamin H. Clegg
ENGINEER

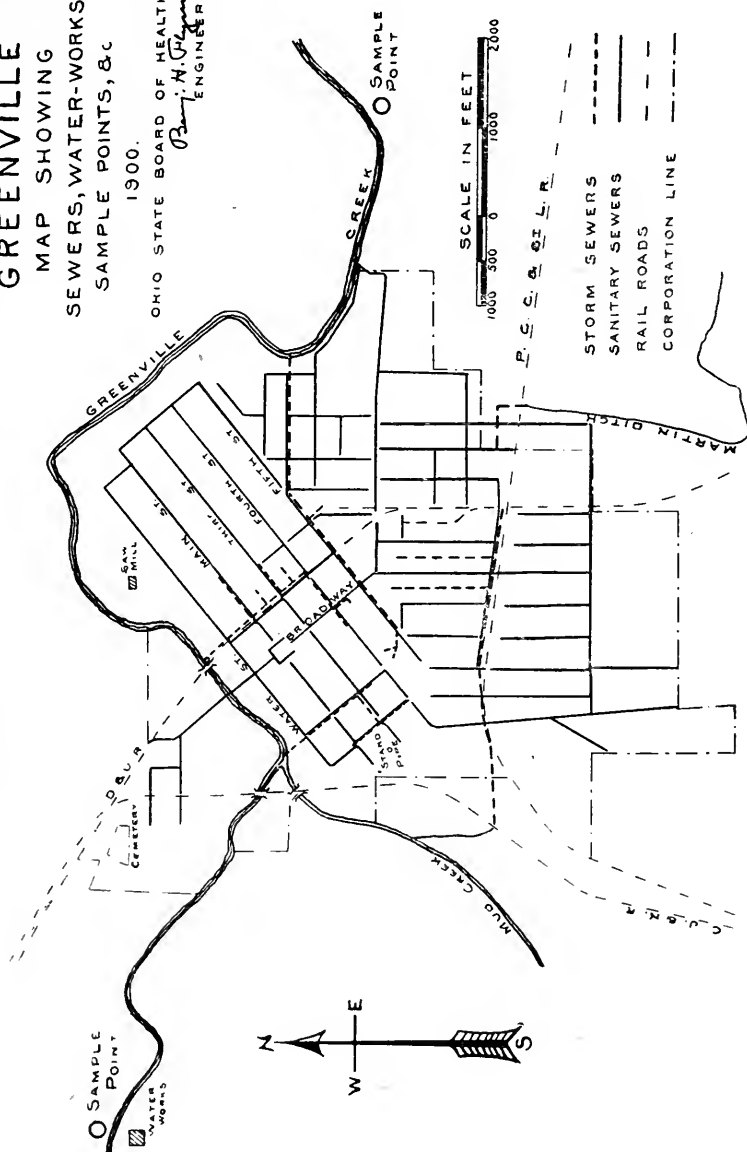


PLATE 6

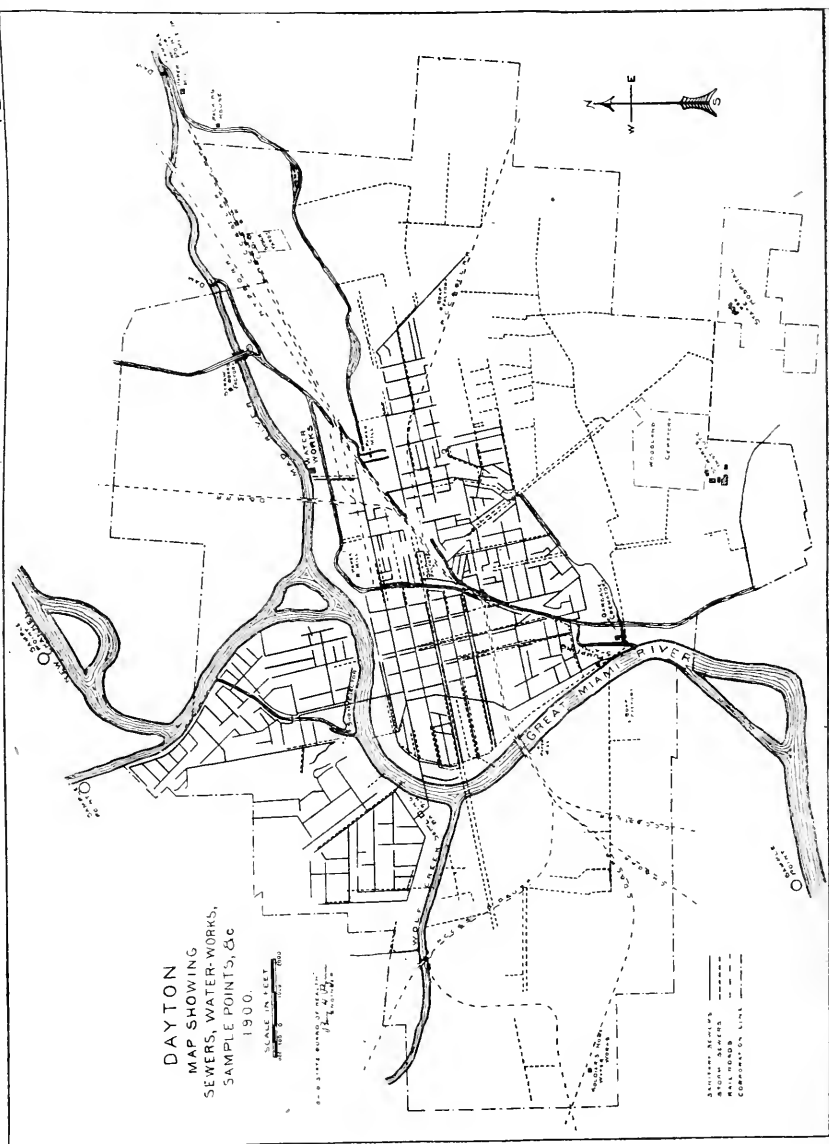
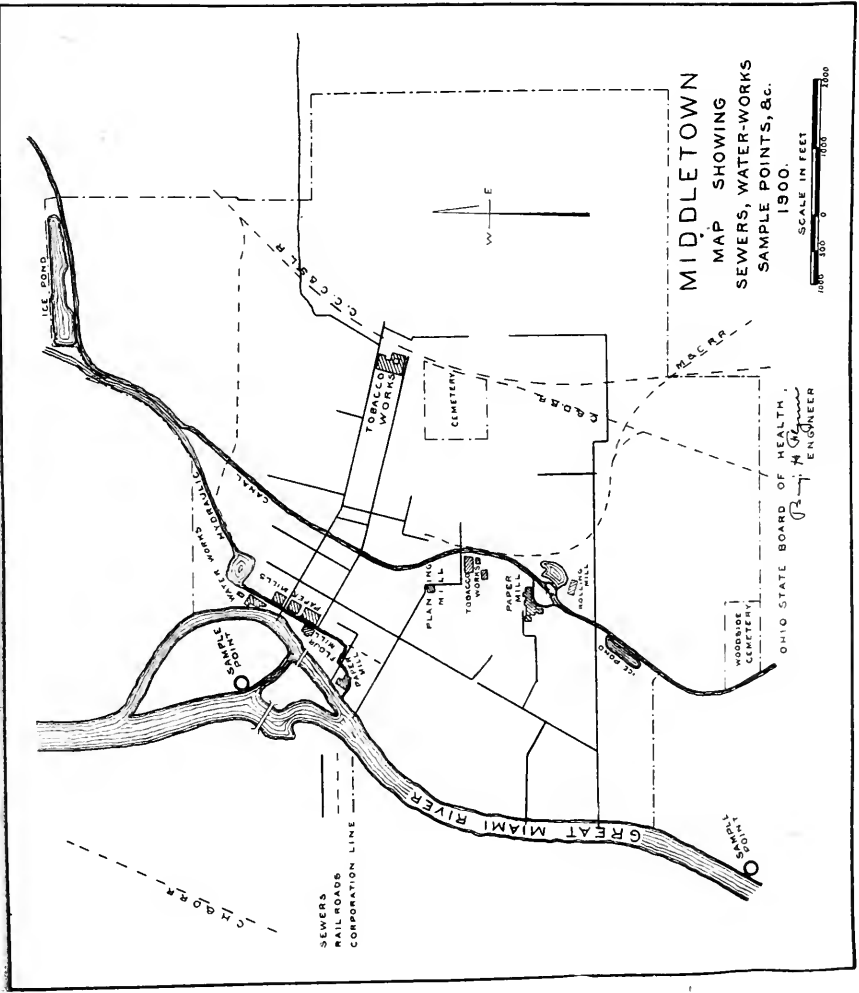


PLATE 7



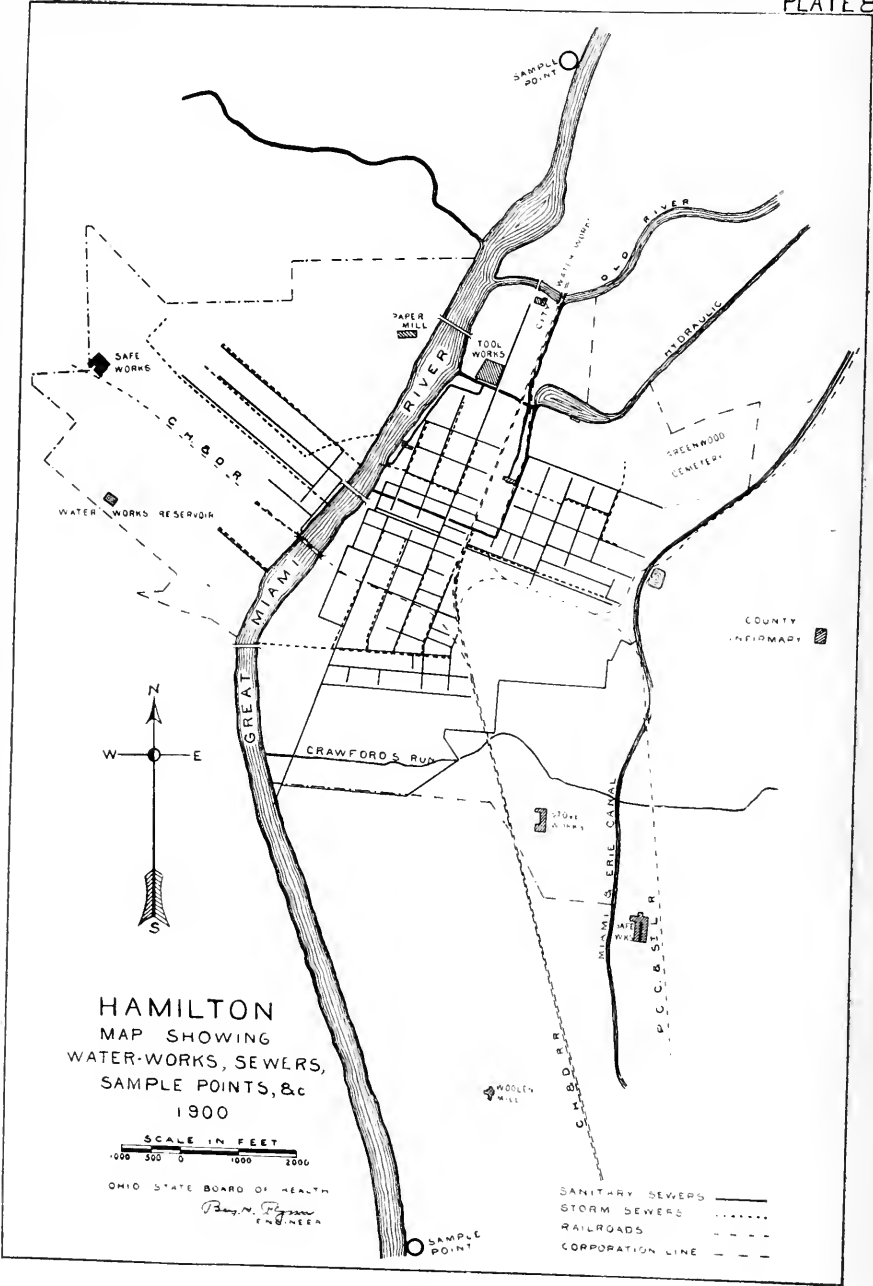
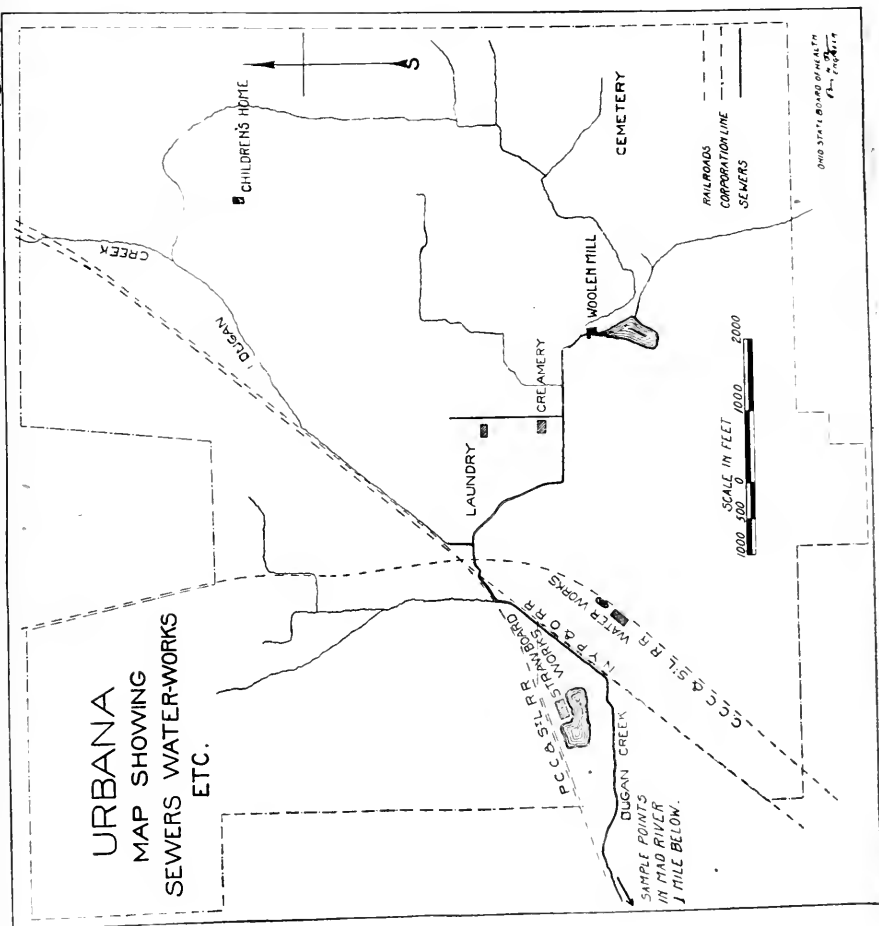
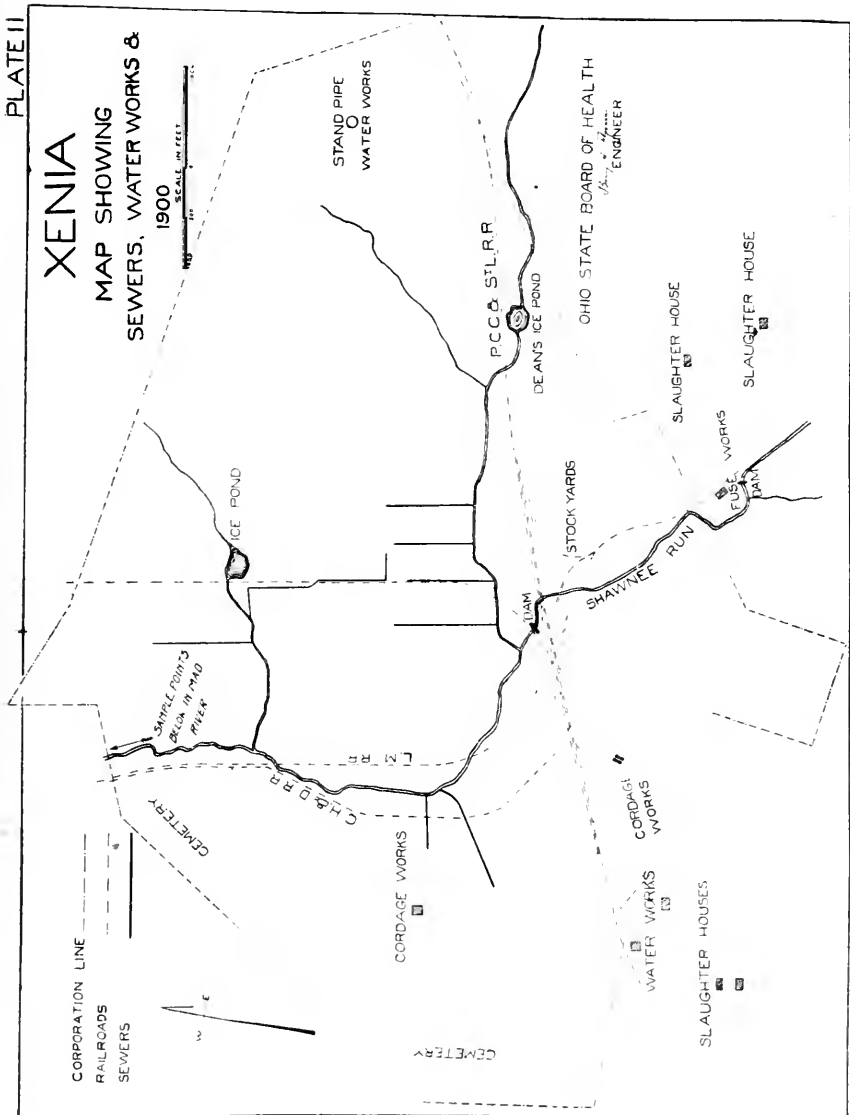


PLATE 9





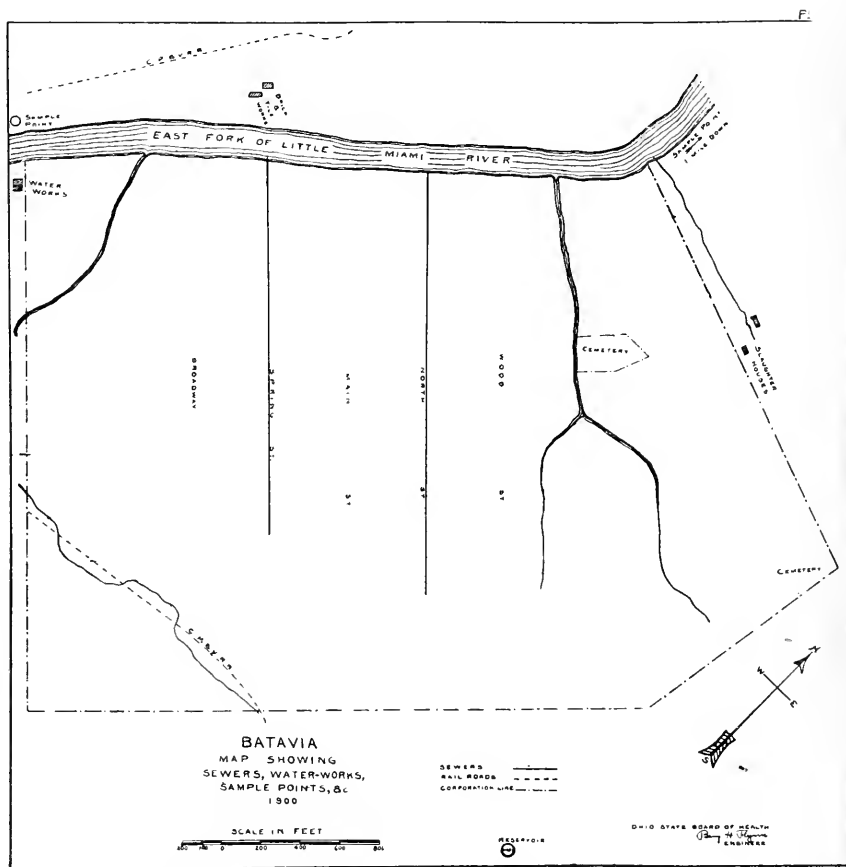
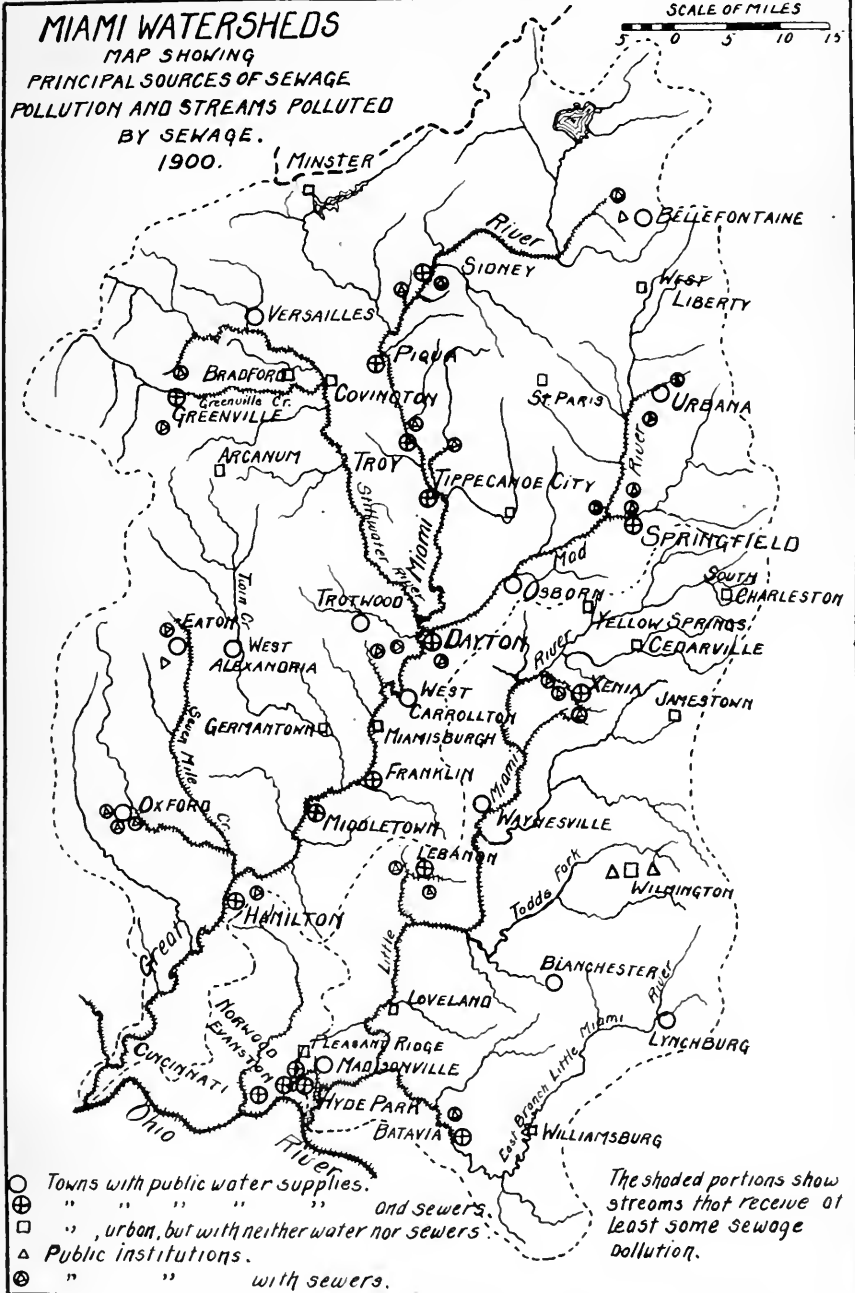


PLATE 13



REPORT OF THE CHEMICAL AND BACTERIOLOGICAL EXAMINATIONS OF THE WATERS OF THE LITTLE MIAMI RIVER AND THE GREAT MIAMI RIVER WITH THEIR TRIBUTARIES.

By E. G. HORTON, B. S.,

CHEMIST AND BACTERIOLOGIST TO THE OHIO STATE BOARD OF HEALTH.

SYNOPSIS.

- I. INTRODUCTION.
- II. METHODS OF EXAMINATION.
- III. LIST OF SAMPLING STATIONS,
 - 1. LITTLE MIAMI RIVER,
 - 2. GREAT MIAMI WATERSHED.
 - a. STILLWATER RIVER,
 - b. MAD RIVER,
 - c. GREAT MIAMI RIVER.
- IV. LIST OF SAMPLES.
- V. RAINFALL,
 - 1. RAINFALL TABLE,
 - 2. WEATHER HISTORY OF SAMPLES.
 - a. LITTLE MIAMI RIVER,
 - b. GREAT MIAMI RIVER.
- VI. RESULTS OF EXAMINATIONS.
- VII. LIST OF PLATES.
- VIII. DISCUSSION OF ANALYTICAL RESULTS.
 - 1. LITTLE MIAMI RIVER,
 - 2. GREAT MIAMI WATERSHED.
 - a. STILLWATER RIVER,
 - b. MAD RIVER,
 - c. GREAT MIAMI RIVER.

I. INTRODUCTION.

The rivers selected for the 1900 investigation were the two Miamis. The work on the Little Miami included the East Fork of that stream, while the tributaries of the Great Miami that were examined are those known as Greenville Creek, Buck Creek, Mad River, and Stillwater River. The relation of the tributaries to the main stream in each case is shown by diagram later. As in previous investigations the plan of work consisted in the examination of chemical and bacteriological samples taken monthly from chosen places or sampling stations. The work extended from April to November inclusive, and in the eight months fifty-four samples were taken from the seven stations on Little Miami River, and one hundred and seventy-six samples from the twenty-two stations on the Great Miami River, making a total of two hundred and thirty samples from twenty-nine sampling points. The April and September collections at South Charleston were not made.

With the amount of routine work on hand it was impossible to determine the absence or presence of intestinal bacteria in all the samples without an increased laboratory force, which was prevented by lack of funds. Some work was done along the line of searching for intestinal bacteria and the results will be found recorded later.

II. METHODS OF EXAMINATION.

The methods followed were the same as those of last year and reference is made to page 470 of the report of the Ohio State Board of Health for 1899, or to page 22 of the Third Report of an Investigation of the Rivers of Ohio.

In looking for intestinal bacteria it was our practice to employ preliminary cultivation over night in 1 per cent. peptone solution (using 10 cc. of 10 times normal peptone and 90 cc. of the water in question) then inoculation was made in 2 per cent. glucose bouillon in fermentation tubes, and on the production of gas, lactose-litmus-agar plates were poured and colonies picked for sub-culture work to identify the forms thus obtained.

III. LIST OF STATIONS.

The following list of sampling stations gives the location of the points where samples were collected, how the samples were taken, and the body of water from which they were taken. As in the preceding work the places selected were near the cities or large towns situated on the stream and just above and below the local pollutions. The expression "from the bank" means from the bank when the current swept up to the bank in such a manner as to give a representative sample, otherwise the collector waded out a few steps from the bank to make the collection.

1. LITTLE MIAMI RIVER.

1. Above South Charleston. The collections were made from a log or from the bank in a little pool just as the stream entered the lot of James Duffey, on the London pike, some three-fourths of a mile from the village.

2 and 3. Above and below Xenia. Both sets of samples were taken from a naphtha launch (or row boat), at Lucas Grove. The upper samples were taken nearly a mile above the mouth of Shawnee Run, and the lower ones just above the dam at the Trebein mill.

4. Above Loveland at a point where the river bends to the highway and Panhandle railroad about a mile above the village. The samples were taken by wading from the east bank.

5. Opposite Linwood where Union levee crosses the river. The samples were taken by wading from the west bank just south of the bridge.

EAST FORK OF LITTLE MIAMI RIVER.

6. Above Batavia. The samples were taken from a boat in the pool opposite the water works. As the intake pipe of the city water works is in this pool the examinations at this station show the character of the water (before filtration) used by Batavia.

7. Below Batavia. The collections were made from the right bank of the stream about half a mile below the outlet of the Clermont County Infirmary's sewer.

2. GREAT MIAMI WATERSHED.

a. STILLWATER BASIN.

8. Above Greenville. The above town samples were taken from the roots of a tree on the right bank, or from a boat, and represented the water in Greenville Creek just above the old intake.

9. Below Greenville. These samples were taken from Greenville Creek by wading at the foot of Martin Street. During the later months the collections were made about half a mile farther down the stream, as the village of Greenville was being sewered and the outlet was at the foot of Martin Street.

10. Above Dayton on Stillwater River. The samples were here collected from a row-boat at the Y. M. C. A. Athletic grounds.

b. MAD RIVER BASIN.

11. Above Urbana. This station was located on Mad River just above the bridge on the Urbana and Westville or Piqua Pike. The collections were made from the bank.

12. Below Urbana. This station on Mad River was a little less than a mile below the mouth of Dugan Creek and was situated a few rods above the Redmond highway bridge crossing the stream at this place. Wading was necessary to obtain representative samples.

13. Above Springfield on Buck Creek. The only station located on Buck Creek was near the Springfield water works pumping station, and at the point where the intake pipe reaches the creek. The first samples were taken from the rocks on the left bank, but the later ones were collected from the planks placed about the mouth of the intake pipe.

14. Above Springfield on Mad River. Samples were taken by wading into the river a short distance below the West Main Street (National road) bridge.

15. Below Springfield on Mad River. The April collection was made just above the old White bridge near John Wood's factory, but later ones were made farther down, where the river bends to the railroad track. At the latter place the collections were made from a projecting rock on the left bank.

16. Above Dayton on Mad River. The samples were taken by wading a few rods above the bridge west of Harshmanville.

C. GREAT MIAMI RIVER BASIN.

(Under this heading is included only the main stream.)

17. Above Sidney. The collections were made from the Great Miami where it is obstructed by the stone dam opposite the water works pumping station.

18. Below Sidney. This station was located on the Great Miami just above Sulphur Spring or White bridge, and the collections were made by wading.

19. Above Piqua. The samples were taken from the right bank just above the Main Street bridge.

20. Below Piqua. This station was established on the left bank of the Great Miami and in front of Henry Dorman's house.

21. Above Troy. The April and May samples were taken from the left bank above the outlet of the sewer from the Miami County Infirmary, but later collections were made from the opposite bank because that point was easier of access.

22. Below Troy. The samples at this place were taken from a boat or by wading at a point on the Edwards farm opposite "Horse Heaven" and a few rods above the Big Four railroad bridge.

23. Above Dayton on the Great Miami River. For seven months this station was just above the Troy pike bridge over the old channel, and the collections were made from the rocks on the left bank. The November sample was taken in the new channel a few rods below the bridge, as the water had been turned into the new channel about two weeks previous to the November sampling.

24. Below Dayton on the Great Miami River. The samples were taken from a row boat off the right bank at the foot of Broadway Street.

Above Middletown. The samples at this station were secured by wading from the east shore a few rods above "Second River" bridge.

26. Below Middletown. This station was located at the swimming hole on the Hale farm. The collections were made from a boat.

27. Above Hamilton. The collections were made on the right bank from the ruins of the old dam opposite station No. 159 on the electric railway between Hamilton and Middletown.

28. Below Hamilton. This station was situated at the camping ground on the Richard Brown farm and the samples were obtained by wading. The April sample was collected from the opposite side of the river.

29. Below Cleves. The April sample was taken below the mouth of Whitewater River, but the latter collections were made from the left bank of the Great Miami about a quarter of a mile below Harold switch on the Cincinnati and Lawrenceburg electric line, and consequently some distance above the mouth of Whitewater River. This change in position of the station was due to the fact that most of the territory drained by the tributary mentioned lies outside of the state of Ohio.

For a better idea of the general distribution of the stations and of their relation to the various tributaries and the main stream, the reader is referred to the diagrammatic representation of the systems of the Little and Great Miami Rivers given on page 470. The relative location of each station to its adjacent city or village is best shown on the individual map for the city or village. See pages 384-394.

IV. LIST OF SAMPLES.

IN THE FOLLOWING LIST THE SAMPLES ARE GIVEN BY SERIAL NUMBER, WHERE AND WHEN TAKEN, AND THE TIME THEY WERE RECEIVED AT THE LABORATORY.

1. Springfield, above, Buck Creek, April 16, 2:50 P. M. Received April 17, 9:45 A. M.

2. Springfield, above, Mad River, April 16, 3:55 P. M. Received April 17, 9:45 A. M.

3. Springfield, below, Mad River, April 16, 4:30 P. M. Received April 17, 9:45 A. M.

4. Troy, above, Great Miami River, April 17, 8:00 A. M. Received April 18, 11:30 A. M.

5. Troy, below, Great Miami River, April 17, 9:00 A. M. Received April 18, 11:30 A. M.

6. Sidney, below, Great Miami River, April 17, 12:20 P. M. Received April 18, 11:30 A. M.

7. Sidney, above, Great Miami River, April 17, 12:50 P. M. Received April 18, 11:30 A. M.

8. Greenville, above, Greenville Creek, April 17, 4:15 P. M. Received April 19, 1:15 P. M.
9. Greenville, below, Greenville Creek, April 17, 5:00 P. M. Received April 19, 1:15 P. M.
10. Dayton, below, Great Miami River, April 18, 9:20 A. M. Received April 19, 1:15 P. M.
11. Dayton, above, Mad River, April 18, 10:40 A. M. Received April 21, 10:30 A. M.
12. Dayton, above, Great Miami River, April 18, 11:50 A. M. Received April 19, 1:15 P. M.
13. Dayton, above, Stillwater River, April 18, 12:15 P. M. Received April 19, 1:15 P. M.
14. Piqua, above, Great Miami River, April 18, 4:00 P. M. Received April 19, 1:15 P. M.
15. Piqua, below, Great Miami River, April 18, 4:40 P. M. Received April 19, 1:15 P. M.
16. Urbana, above, Made River, April 19, 10:45 A. M. Received April 20, 8:00 A. M.
17. Urbana, below, Mad River, April 19, 12:00 M. Received April 20, 8:00 A. M.
18. Loveland, above, Little Miami River, April 24, 10:30 A. M. Received April 25, 9:30 A. M.
19. Linwood, below, Little Miami River, April 24, 3:00 P. M. Received April 25, 4:15 P. M.
20. Batavia, above, East Fork of Little Miami River, April 25, 7:45 A. M. Received April 26, 9:00 A. M.
21. Batavia, below, East Fork of Little Miami River, April 25, 8:00 A. M. Received April 26, 9:00 A. M.
22. Cleves, below, Great Miami River, April 25, 12:00 M. Received April 26, 11:15 A. M.
23. Hamilton, below, Great Miami River, April 25, 5:15 P. M. Received April 27, 8:00 A. M.
24. Hamilton, above, Great Miami River, April 25, 6:00 P. M. Received April 27, 8:00 A. M.
25. Middletown, below, Great Miami River, April 26, 8:30 A. M. Received April 27, 10:00 A. M.
26. Middletown, above, Great Miami River, April 26, 9:15 A. M. Received April 27, 10:00 A. M.
27. Xenia, above, Little Miami River, April 26, 3:00 P. M. Received April 27, 8:00 A. M.
28. Xenia, below, Little Miami River, April 26, 3:20 P. M. Received April 27, 8:00 A. M.
29. Piqua, above, Great Miami River, May 22, 9:45 A. M. Received May 23, 2:00 P. M.

30. Piqua, below, Great Miami River, May 22, 10:15 A. M. Received May 23, 2:00 P. M.

31. Sidney, below, Great Miami River, May 22, 12:30 P. M. Received May 24, 9:45 A. M.

32. Sidney, above, Great Miami River, May 22, 1:15 P. M. Received May 24, 9:45 A. M.

33. Greenville, above, Greenville Creek, May 22, 1:15 P. M. Received May 24, 9:45 A. M.

34. Greenville, below, Greenville Creek, May 22, 5:30 P. M. Received May 24, 9:45 A. M.

35. Dayton, below, Great Miami River, May 23, 8:00 A. M. Received May 25, 8:00 A. M.

36. Dayton, above, Mad River, May 23, 9:05 A. M. Received May 25, 8:00 A. M.

37. Dayton, above, Great Miami River, May 23, 10:00 A. M. Received May 25, 8:00 A. M.

38. Dayton, above, Stillwater River, May 23, 10:25 A. M. Received May 25, 8:00 A. M.

39. Troy, below, Great Miami River, May 22, 3:40 P. M. Received May 24, 2:00 P. M.

40. Troy, above, Great Miami River, May 22, 4:25 P. M. Received May 24, 2:00 P. M.

41. Urbana, above, Mad River, May 24, 7:30 A. M. Received May 25, 9:30 A. M.

42. Urbana below, Mad River, May 24, 8:30 A. M. Received May 25, 9:30 A. M.

43. Springfield, below, Mad River, May 24, 11:30 A. M. Received May 25, 10:30 A. M.

44. Springfield, above, Mad River, May 24, 12:00 M. Received May 25, 10:30 A. M.

45. Springfield, above, Buck Creek, May 24, 2:20 P.M. Received May 25, 10:30 A. M.

46. South Charleston, above, Little Miami River, May 28, 8:30 A. M. Received May 29, 11:00 A. M.

47. Xenia, above, Little Miami River, May 28, 11:30 A. M. Received May 29, 8:30 A. M.

48. Xenia, below, Little Miami River, May 28, 12:00 M. Received May 29, 8:30 A. M.

49. Middletown, above, Great Miami River, May 28, 3:45 P. M. Received May 30, 8:00 A. M.

50. Middletown, below, Great Miami River, May 28, 4:15 P. M. Received May 30, 8:00 A. M.

51. Hamilton, above Great Miami River, May 28, 5:30 P. M. Received May 30, 9:00 A. M.

52. Hamilton, below, Great Miami River, May 28, 6:15 P. M. Received May 30, 9:00 A. M.

53. Cleves, below, Great Miami River, May 29, 8:00 A. M. Received May 30, 11:00 A. M.
54. Linwood, below, Little Miami River, May 29, 12:45 P. M. Received May 30, 9:30 A. M.
55. Loveland, above, Little Miami River, May 29, 3:30 P. M. Received May 30, 8:00 A. M.
56. Batavia, below, East Fork of Little Miami River, June 1, 2:30 P. M. Received June 2, 9:00 A. M.
57. Batavia, above, East Fork of Little Miami River, June 1, 3:00 P. M. Received June 2, 9:00 A. M.
58. Piqua, above, Great Miami River, June 18, 9:45 A. M. Received June 19, 8:00 A. M.
59. Piqua, below, Great Miami River, June 18, 10:15 A. M. Received June 19, 8:00 A. M.
60. Sidney, below, Great Miami River, June 18, 12:30 P. M. Received June 20, 10:00 A. M.
61. Sidney, above, Great Miami River, June 18, 1:15 P. M. Received June 20, 10:00 A. M.
62. Greenville, above, Greenville Creek, June 18, 4:00 P. M. Received June 20, 10:00 A. M.
63. Greenville, below, Greenville Creek, June 18, 4:30 P. M. Received June 20, 10:00 A. M.
64. Dayton, below, Great Miami River, June 19, 7:30 A. M. Received June 20, 8:30 A. M.
65. Dayton, above, Mad River, June 19, 9:30 A. M. Received June 20, 8:30 A. M.
66. Dayton, above, Great Miami River, June 19, 10:30 A. M. Received June 20, 8:30 A. M.
67. Dayton, above, Stillwater River, June 19, 11:00 A. M. Received June 20, 8:30 A. M.
68. Troy, below, Great Miami River, June 19, 3:30 P. M. Received June 21, 8:00 A. M.
69. Troy, above, Great Miami River, June 19, 4:45 P. M. Received June 21, 8:00 A. M.
70. Urbana, below, Mad River, June 20, 8:15 A. M. Received June 20, 8:00 P. M.
71. Urbana, above, Mad River, June 20, 9:15 A. M. Received June 20, 8:00 P. M.
72. Springfield, above, Buck Creek, June 20, 1:30 P. M. Received June 21, 10:00 A. M.
73. Springfield, above, Mad River, June 20, 2:45 P. M. Received June 21, 10:00 A. M.
74. Springfield, below, Mad River, June 20, 3:30 P. M. Received June 21, 10:00 A. M.
75. South Charleston, above, Little Miami River, June 26, 8:30 A. M. Received June 27, 8:20 A. M.

76. Loveland, above, Little Miami River, June 26, 1:35 P. M. Received June 27, 8:20 A. M.

77. Linwood, below, Little Miami River, June 26, 5:00 P. M. Received June 28, 8:30 A. M.

78. Batavia, above, East Fork of Little Miami River, June 27, 7:15 A. M. Received June 28, 8:30 A. M.

79. Batavia, below, East Fork of Little Miami River, June 27, 8:00 A. M. Received June 28, 8:30 A. M.

80. Cleves, below, Great Miami River, June 27, 11:30 A. M. Received June 28, 10:00 A. M.

81. Hamilton, above, Great Miami River, June 27, 6:00 P. M. Received June 30, 8:40 A. M.

82. Hamilton, below, Great Miami River, June 27, 7:00 P. M. Received June 30, 8:40 A. M.

83. Middletown, above, Great Miami River, June 28, 7:30 A. M. Received June 29, 10:00 A. M.

84. Middletown, below, Great Miami River, June 28, 8:00 A. M. Received June 29, 10:00 A. M.

85. Xenia, above, Little Miami River, June 28, 11:30 A. M. Received June 29, 8:25 A. M.

86. Xenia, below, Little Miami River, June 28, 12:00 M. Received June 29, 8:25 A. M.

87. Urbana, below, Mad River, July 9, 9:30 A. M. Received July 10, 8:15 A. M.

88. Urbana, above, Mad River, July 9, 10:15 A. M. Received July 10, 8:15 A. M.

89. Sidney, below, Great Miami River, July 9, 2:30 P. M. Received July 11, 9:45 A. M.

90. Sidney, above, Great Miami River, July 9, 3:30 P. M. Received July 11, 9:45 A. M.

91. Greenville, above, Greenville Creek, July 10, 6:00 A. M. Received July 11, 9:45 A. M.

92. Greenville, below Greenville Creek, July 10, 6:45 A. M. Received July 11, 9:45 A. M.

93. Dayton, above, Mad River, July 10, 11:00 A. M. Received July 11, 9:45 A. M.

94. Dayton, above, Great Miami River, July 10, 12:00 M. Received July 11, 9:45 A. M.

95. Dayton, above, Stillwater River, July 10, 12:45 P. M. Received July 11, 9:45 A. M.

96. Dayton, below, Great Miami River, July 10, 1:30 P. M. Received July 11, 9:45 A. M.

97. Springfield, above, Mad River, July 10, 4:00 P. M. Received July 11, 3:30 P. M.

98. Springfield, below, Mad River, July 10, 4:45 P. M. Received July 11, 3:30 P. M.

99. Springfield, above, Buck Creek, July 10, 6:30 P. M. Received July 11, 3:30 P. M.
100. Troy, below, Great Miami River, July 11, 8:45 A. M. Received July 12, 9:15 A. M.
101. Troy, above, Great Miami River, July 11, 9:45 A. M. Received July 12, 9:15 A. M.
102. Piqua, below, Great Miami River, July 11, 11:30 A. M. Received July 12, 8:30 A. M.
103. Piqua, above, Great Miami River, July 11, 12:00 M. Received July 12, 8:30 A. M.
104. Xenia, below, Little Miami River, July 17, 9:20 A. M. Received July 18, 8:15 A. M.
105. Xenia, above, Little Miami River, July 17, 9:40 A. M. Received July 18, 8:15 A. M.
106. Loveland, above, Little Miami River, July 17, 1:30 P. M. Received July 18, 8:00 A. M.
107. South Charleston, above, Little Miami River, July 17, 5:30 P. M. Received July 18, 8:00 A. M.
108. Middletown, above, Great Miami River, July 19, 10:00 A. M. Received July 20, 9:30 A. M.
109. Middletown, below, Great Miami River, July 19, 10:30 A. M. Received July 20, 9:30 A. M.
110. Hamilton, above, Great Miami River, July 19, 12:15 P. M. Received July 20, 9:00 A. M.
111. Hamilton, below, Great Miami River, July 19, 1:15 P. M. Received July 20, 9:00 A. M.
112. Linwood, below, Little Miami River, July 19, 4:30 P. M.. Received July 21, 9:00 A. M.
113. Batavia, below, East Fork of Little Miami River, July 20, 7:00 A. M. Received July 21, 9:00 A. M.
114. Batavia, above, East Fork of Little Miami River, July 20, 8:00 A. M. Received July 21, 9:00 A. M.
115. Cleves, below, Great Miami River, July 20, 11:25 A. M. Received July 21, 10:00 A. M.
116. Piqua, above, Great Miami River, Aug. 7, 9:45 A. M. Received August 8, 8:30 A. M.
117. Piqua, below, Great Miami River, Aug. 7, 10:15 A. M. Received Aug. 8, 8:30 A. M.
118. Sidney, below, Great Miami River, Aug. 7, 12:30 P. M. Received Aug. 9, 10:00 A. M.
119. Sidney, above, Great Miami River, Aug. 7, 1:15 P. M. Received Aug. 9, 10:00 A. M.
120. Greenville, above, Greenville Creek, Aug. 7, 4:30 P. M. Received Aug. 9, 10:00 A. M.
121. Greenville, below, Greenville Creek, Aug. 7, 5:30 P. M. Received Aug. 9, 10:00 A. M.

122. Dayton, below, Great Miami River, Aug. 8, 7:30 A. M. Received Aug. 9, 10:00 A. M.

123. Dayton, above, Mad River, Aug. 8, 9:30 A. M. Received Aug. 9, 10:00 A. M.

124. Dayton, above, Great Miami River, Aug. 8, 10:45 A. M. Received Aug. 9, 10:00 A. M.

125. Dayton, above, Stillwater River, Aug. 8, 11:20 A. M. Received Aug. 9, 10:00 A. M.

126. Troy, below, Great Miami River, Aug. 8, 4:00 P. M. Received Aug. 9, 2:00 P. M.

127. Troy, above, Great Miami River, Aug. 8, 5:15 P. M. Received Aug. 9, 2:00 P. M.

128. Urbana, above, Mad River, Aug. 9, 8:00 A. M. Received Aug. 10, 10:00 A. M.

129. Urbana, below, Mad River, Aug. 9, 8:45 A. M. Received Aug. 10, 10:00 A. M.

130. Springfield, below, Mad River, Aug. 9, 1:00 P. M. Received Aug. 10, 10:00 A. M.

131. Springfield, above, Mad River, Aug. 9, 1:45 P. M. Received Aug. 10, 10:00 A. M.

132. Springfield, above, Buck Creek, Aug. 9, 3:30 P. M. Received Aug. 10, 10:00 A. M.

133. South Charleston, above, Little Miami River, Aug. 20, 8:45 A. M. Received Aug. 20, 4:00 P. M.

134. Loveland, above, Little Miami River, Aug. 20, 1:00 P. M. Received Aug. 21, 10:00 A. M.

135. Linwood, below, Little Miami River, Aug. 20, 4:15 P. M. Received Aug. 22, 8:00 A. M.

136. Batavia, below, East Fork of Little Miami River, Aug. 21, 7:15 A. M. Received Aug. 22, 8:15 A. M.

137. Batavia, above, East Fork of Little Miami River, Aug. 21, 8:00 A. M. Received Aug. 22, 8:15 A. M.

138. Cleves, below, Great Miami River, Aug. 21, 12:15 P. M. Received Aug. 22, 8:15 A. M.

139. Hamilton, below, Great Miami River, Aug. 21, 4:30 P. M. Received Aug. 23, 8:45 A. M.

140. Hamilton, above, Great Miami River, Aug. 21, 5:30 P. M. Received Aug. 23, 8:45 A. M.

141. Middletown, above, Great Miami River, Aug. 22, 7:15 A. M. Received Aug. 23, 8:00 A. M.

142. Middletown, below, Great Miami River, Aug. 22, 8:00 A. M. Received Aug. 23, 8:00 A. M.

143. Xenia, above, Little Miami River, Aug. 22, 11:15 A. M. Received Aug. 23, 8:45 A. M.

144. Xenia, below, Little Miami River, Aug. 22, 11:45 A. M. Received Aug. 23, 8:45 A. M.

145. Piqua, above, Great Miami River, Sept. 3, 9:45 A. M. Received Sept. 4, 2:10 P. M.
146. Piqua, below, Great Miami River, Sept. 3, 10:15 A. M. Received Sept. 4, 2:10 P. M.
147. Sidney, below, Great Miami River, Sept. 3, 12:30 P. M. Received Sept. 5, 8:00 A. M.
148. Sidney, above, Great Miami River, Sept. 3, 1:15 P. M. Received Sept. 5, 8:00 A. M.
149. Greenville, above, Greenville Creek, Sept. 3, 4:30 P. M. Received Sept. 5, 8:00 A. M.
150. Greenville, below, Greenville Creek, Sept. 3, 5:00 P. M. Received Sept. 5, 8:00 A. M.
151. Dayton, above, Mad River, Sept. 4, 8:30 A. M. Received Sept. 5, 8:00 A. M.
152. Dayton, above, Great Miami River, Sept. 4, 9:45 A. M. Received Sept. 5, 8:00 A. M.
153. Dayton, above, Stillwater River, Sept. 4, 10:45 A. M. Received Sept. 5, 8:00 A. M.
154. Dayton, below, Great Miami River, Sept. 4, 11:45 A. M. Received Sept. 5, 8:00 A. M.
155. Troy, below, Great Miami River, Sept. 4, 3:45 P. M. Received Sept. 5, 8:00 A. M.
156. Troy, above, Great Miami River, Sept. 4, 4:45 P. M. Received Sept. 5, 8:00 A. M.
157. Urbana, below, Mad River, Sept. 5, 7:45 A. M. Received Sept. 6, 8:00 A. M.
158. Urbana, above, Mad River, Sept. 5, 8:30 A. M. Received Sept. 6, 8:00 A. M.
159. Springfield, above, Mad River, Sept. 5, 11:15 A. M. Received Sept. 6, 8:00 A. M.
160. Springfield, below, Mad River, Sept. 5, 12:00 M. Received Sept. 6, 8:00 A. M.
161. Springfield, above, Buck Creek, Sept. 5, 2:15 P. M. Received Sept. 6, 8:00 A. M.
162. Xenia, above, Little Miami River, Sept. 17, 11:30 A. M. Received Sept. 18, 10:00 A. M.
163. Xenia, below, Little Miami River, Sept. 17, 12:15 P. M. Received Sept. 18, 10:00 A. M.
164. Loveland, above, Little Miami River, Sept. 17, 5:15 P. M. Received Sept. 18, 10:00 A. M.
165. Cleves, below, Great Miami River, Sept. 18, 7:30 A. M. Received Sept. 19, 8:00 A. M.
166. Linwood, below, Little Miami River, Sept. 18, 4:30 P. M. Received Sept. 20, 9:45 A. M.
167. Batavia, below, East Fork of Little Miami River, Sept. 19, 7:00 A. M. Received Sept. 20, 9:45 A. M.

168. Batavia, above, East Fork of Little Miami River, Sept. 19, 8:00 A. M. Received Sept. 20, 9:45 A. M.
169. Hamilton, below, Great Miami River, Sept. 19, 12:30 P. M. Received Sept. 20, 9:45 A. M.
170. Hamilton, above, Great Miami River, Sept. 19, 1:30 P. M. Received Sept. 20, 9:45 A. M.
171. Middletown, below, Great Miami River, Sept. 19, 2:15 P. M. Received Sept. 20, 8:00 A. M.
172. Middletown, above, Great Miami River, Sept. 19, 3:00 P. M. Received Sept. 20, 8:00 A. M.
173. Sidney, below, Great Miami River, Oct. 1, 11:30 A. M. Received Oct. 3, 8:30 A. M.
174. Sidney, above, Great Miami River, Oct. 1, 12:45 P. M. Received Oct. 3, 8:30 A. M.
175. Piqua, above Great Miami River, Oct. 1, 2:15 P. M. Received Oct. 2, 9:00 A. M.
176. Piqua, below, Great Miami River, Oct. 1, 2:45 P. M. Received Oct. 2, 9:00 A. M.
177. Greenville, below, Greenville Creek, Oct. 1, 4:30 P. M. Received Oct. 3, 8:30 A. M.
178. Greenville, above, Greenville Creek, Oct. 1, 5:30 P. M. Received Oct. 3, 8:30 A. M.
179. Dayton, below, Great Miami River, Oct. 2, 7:45 A. M. Received Oct. 3, 8:30 A. M.
180. Dayton, above, Mad River, Oct. 2, 9:30 A. M. Received Oct. 3, 8:30 A. M.
181. Dayton, above, Great Miami River, Oct. 2, 10:45 A. M. Received Oct. 3, 8:30 A. M.
182. Dayton, above, Stillwater River, Oct. 2, 11:15 A. M. Received Oct. 3, 8:30 A. M.
183. Troy, below, Great Miami River, Oct. 2, 3:45 P. M. Received Oct. 4, 8:00 A. M.
184. Troy, above, Great Miami River, Oct. 2, 4:45 P. M. Received Oct. 4, 8:00 A. M.
185. Urbana, above, Mad River, Oct. 3, 7:45 A. M. Received Oct. 4, 8:00 A. M.
186. Urbana, below, Mad River, Oct. 3, 8:45 A. M. Received Oct. 4, 8:00 A. M.
187. Springfield, below, Mad River, Oct. 3, 11:30 A. M. Received Oct. 4, 8:00 A. M.
188. Springfield, above, Mad River, Oct. 3, 12:15 P. M. Received Oct. 4, 8:00 A. M.
189. Springfield, above, Buck Creek, Oct. 3, 2:30 P. M. Received Oct. 4, 8:00 A. M.
190. Middletown, above, Great Miami River, Oct. 13, 6:00 A. M. Received Oct. 15, 9:00 A. M.

191. Middletown, below, Great Miami River, Oct. 13, 6:45 A. M. Received Oct. 15, 9:00 A. M.
192. Hamilton, above, Great Miami River, Oct. 13, 8:30 A. M. Received Oct. 15, 8:00 A. M.
193. Hamilton, below, Great Miami River, Oct. 13, 9:30 A. M. Received Oct. 15, 8:00 A. M.
194. Cleves, below, Great Miami River, Oct. 13, 1:30 P. M. Received Oct. 15, 9:00 A. M.
195. Linwood, above, Little Miami River, Oct. 13, 4:00 P. M. Received Oct. 16, 9:45 A. M.
196. South Charleston, above, Little Miami River, Oct. 18, 8:30 A. M. Received Oct. 19, 9:30 A. M.
197. Xenia, above, Little Miami River, Oct. 18, 11:15 A. M. Received Oct. 19, 10:30 A. M.
198. Xenia, below, Little Miami River, Oct. 18, 11:45 A. M. Received Oct. 19, 10:30 A. M.
199. Loveland, above, Little Miami River, Oct. 19, 6:00 A. M. Received Oct. 20, 8:00 A. M.
200. Batavia, above, East Fork of Little Miami River, Oct. 19, 11:10 A. M. Received Oct. 20, 1:45 P. M.
201. Batavia, below, East Fork of Little Miami River, Oct. 19, 1:00 P. M. Received Oct. 20, 1:45 P. M.
202. Piqua above, Great Miami River, Nov. 1, 9:45 A. M. Received Nov. 2, 8:00 A. M.
203. Piqua, below, Great Miami River, Nov. 1, 10:15 A. M. Received Nov. 2, 8:00 A. M.
204. Sidney, below, Great Miami River, Nov. 1, 11:30 A. M. Received Nov. 3, 8:00 A. M.
205. Sidney, above, Great Miami River, Nov. 1, 1:15 P. M. Received Nov. 3, 8:00 A. M.
206. Greenville, above, Greenville Creek, Nov. 1, 4:30 P. M. Received Nov. 2, 8:00 A. M.
207. Greenville, below, Greenville Creek, Nov. 1, 5:00 P. M. Received Nov. 2, 8:00 A. M.
208. Dayton, below, Great Miami River, Nov. 2, 8:00 A. M. Received Nov. 3, 8:00 A. M.
209. Dayton, above, Mad River, Nov. 2, 9:15 A. M. Received Nov. 3, 8:00 A. M.
210. Dayton, above, Great Miami River, Nov. 2, 10:45 A. M. Received Nov. 3, 8:00 A. M.
211. Dayton, above, Stillwater River, Nov. 2, 11:15 A. M. Received Nov. 3, 8:00 A. M.
212. Troy, below, Great Miami River, Nov. 2, 3:45 P. M. Received Nov. 3, 8:00 A. M.
213. Troy, above, Great Miami River, Nov. 2, 4:45 P. M. Received Nov. 3, 8:00 A. M.

214. Springfield, below, Mad River, Nov. 3, 7:00 A. M. Received Nov. 3, 4:15 P. M.
215. Springfield, above, Mad River, Nov. 3, 7:45 A. M. Received Nov. 3, 4:15 P. M.
216. Springfield, above, Buck Creek, Nov. 3, 9:00 A. M. Received Nov. 5, 8:00 A. M.
217. Urbana, above, Mad River, Nov. 3, 11:30 A. M. Received Nov. 3, 5:00 P. M.
218. Urbana, below, Mad River, Nov. 3, 12:15 P. M. Received Nov. 3, 5:00 P. M.
219. South Charleston, above, Little Miami River, Nov. 7, 8:30 A. M. Received Nov. 8, 8:00 A. M.
220. Middletown, above, Great Miami River, Nov. 7, 1:45 P. M. Received Nov. 8, 8:00 A. M.
221. Middletown, below, Great Miami River, Nov. 7, 2:30 P. M. Received Nov. 8, 8:00 A. M.
222. Hamilton, above, Great Miami River, Nov. 7, 3:30 P. M. Received Nov. 8, 4:00 P. M.
223. Hamilton, below, Great Miami River, Nov. 7, 4:30 P. M. Received Nov. 8, 4:00 P. M.
224. Linwood, below, Little Miami River, Nov. 8, 7:30 A. M. Received Nov. 9, 8:00 A. M.
225. Batavia, above, East Fork of Little Miami River, Nov. 8, 9:30 A. M. Received Nov. 10, 10:00 A. M.
226. Batavia, below, East Fork of Little Miami River, Nov. 8, 10:30 A. M. Received Nov. 9, 8:00 A. M.
227. Cleves, below, Great Miami River, Nov. 8, 3:30 P. M. Received Nov. 9, 8:00 A. M.
228. Loveland, above, Little Miami River, Nov. 9, 7:30 A. M. Received Nov. 9, 2:15 P. M.
229. Xenia, below, Little Miami River, Nov. 9, 12:30 P. M. Received Nov. 10, 10:00 A. M.
230. Xenia, above, Little Miami River, Nov. 9, 1:15 P. M. Received Nov. 10, 10:00 A. M.

V. RAINFALL.

Since the character of a river water is greatly affected in many cases by the addition of surface washings, and since the presence of surface washings in the water of a stream is so largely dependent on weather conditions, it is essential in a study of this kind to take into consideration the time and amount of recent rainfalls. To that end the following rainfall table was compiled from the monthly reports of the Ohio section of the United States weather bureau.

The table includes the date and amount of rainfall for those observing stations of the weather bureau located upon the area drained by the Little Miami River, the Great Miami River, and their tributaries (except Whitwater River). The sum of the amounts given may not equal the total for that month, as precipitations of less than one-tenth inch have been omitted from the table.

For convenience the observing stations were grouped as follows:

Little Miami River basin.

(a). Little Miami River.

(b). East fork of Little Miami River.

Great Miami River basin.

(a). Stillwater River (including Greenville Creek).

(b). Mad River (including Buck Creek).

(c). Great Miami River.

RAINFALL TABLE.

DAYS ON WHICH ONE-TENTH INCH OR MORE RAINFALL OCCURED.

LITTLE MIAMI RIVER BASIN.

Station.	April.	Rain.	May.	Rain.	June.	Rain.	July.	Rain.	August.	Rain.	September.	Rain.	October.	Rain.	November.	Rain.
Plattsburg	2	.25	8	.38	1	.10	5	.25	12	.10	3	.43	6	.45	1	.22
	11	.35	9	.35	2	.33	8	.10	16	.77	7	.37	7	1.55	8	.10
	17	.55	18	.12	8	.25	9	.10	20	.37	20	.12	23	.20	.....	.....
	18	.13	19	.10	21	.40	12	.60	21	.36	27	2.70	.....	.....	.....	.....
	21	.17	30	.30	24	.65	16	.15	24	.20	29	.50	.....	.....	.....	.....
	22	.10	31	.20	25	.40	17	.45	26	.55	.....	.....	.....	.....	.....	.....
	.....	.....	.....	.....	29	.15	18	1.75	27	.30	.....	.....	.....	.....	.....	.....
	.....	.....	.....	.....	30	.11	19	1.00	.....	.....	.....	.....	.....	.....	.....	.....
	.....	.....	.....	.....	.....	.45	24	.45	.....	.....	.....	.....	.....	.....	.....	.....
	.....	.....	.....	.....	.....	.25	25	.30	.....	.....	.....	.....	.....	.....	.....	.....
	.....	.....	.....	.....	.....	.30	25	.30	.....	.....	.....	.....	.....	.....	.....	.....
	.....	.....	.....	.....	.....	.30	30	.70	.....	.....	.....	.....	.....	.....	.....	.....
Total rainfall.....	...	1.60	...	1.48	...	2.44	...	5.80	...	2.65	...	4.12	...	2.33	...	4.88
Departure from normal .....	...	-1.66	...	-2.23	...	-0.86	...	+1.59	...	+0.13	...	+1.29	...	+0.67	...	+1.35
Clifton	11	.56	8	.24	.....	.....	8	.20	12	.40	.....	.....	.....	.....	.....	.....
	17	.49	9	.50	.....	.....	12	.24	15	1.05	.....	.....	.....	.....	.....	.....
	21	.60	18	.65	.....	.....	16	.14	20	.70	.....	.....	.....	.....	.....	.....
	22	.20	19	.13	.....	.....	17	.52	21	.45	.....	.....	.....	.....	.....	.....
	.....	.28	.....	.21	.....	.....	18	1.17	26	.52	.....	.....	.....	.....	.....	.....
	.....	31	.....	.18	.....	.....	19	2.08	27	.30	.....	.....	.....	.....	.....	.....
	.....	.....	.....	.....	.....	.....	25	.50	.....	.....	.....	.....	.....	.....	.....	.....
Total rainfall.....	...	1.90	...	1.97	...	.....	...	5.14	...	3.56	...	.....	...	.....	...	.....
Departure from normal .....	...	.....	...	.....	...	.....	...	+1.11	...	.....	...	.....	...	.....	...	.....

LITTLE MIAMI RIVER BASIN—Concluded.

Station.	April.	Rain.	May.	Rain.	June.	Rain.	July.	Rain.	August	Rain.	September.	Rain.	October.	Rain.	November.	Rain.
Cedarville	10	.58	8	.90	7	.16	7	.18	12	.98	3	.19	6	.43	1	.24
	17	.38	9	.39	8	.28	17	1.37	15	1.48	6	.13	7	1.13	...	...
	18	.17	18	.15	14	.15	19	1.04	20	.42	20	.13	16	.10	...	...
	20	.25	19	.27	21	.12	25	.66	25	.73	27	.30	23	.23	...	...
	21	.38	27	.27	22	.15	...	...	26	.27	...	...	...	...	...	...
	22	.28	28	.26	24	.85	...	...	...	...	...	...	...	...	...	...
	...	.29	.38	29	.37	...	...	...	...	...	...	...	...	...	...	...
	...	...	31	.38	...	...	...	...	...	...	...	...	...	...	...	...
Total rainfall.....	...	2.17	...	3.63	...	2.44	...	3.67	...	4.05	...	0.82	...	2.01	...	4.93
Departure from normal .....	...	-0.46	...	-1.03	...	-0.11	...	-0.78	...	+1.81	...	-1.60	...	+0.15	...	+1.34
Waynesville	11	.50	8	1.20	1	.25	6	.10	3	.66	3	.33	7	1.24	1	.23
	17	.67	9	.49	6	.28	8	.32	12	1.00	20	.13	23	.58	...	...
	21	.12	18	1.30	15	.10	16	.24	14	.40	29	.37	30	.27	...	...
	22	.14	19	.63	22	.39	17	.15	15	.27	...	...	...	...	...	...
	...	.25	.20	.24	.35	.18	...	1.04	16	1.70	...	...	...	...	...	...
	...	.27	.65	.28	.25	.19	...	1.38	20	.20	...	...	...	...	...	...
	...	.28	.61	.29	.47	.20	...	.41	21	.10	...	...	...	...	...	...
	...	.29	.45	...	...	...	...	.56	23	.20	...	...	...	...	...	...
	...	.31	.33	...	...	...	...	.82	24	.10	...	...	...	...	...	...
	...	...	...	...	...	...	...	...	25	1.50	...	...	...	...	...	...
	...	...	...	...	...	...	...	...	26	.15	...	...	...	...	...	...
	...	...	...	...	...	...	...	...	27	.25	...	...	...	...	...	...
Total rainfall.....	...	1.66	...	5.94	...	2.15	...	5.12	...	6.56	...	0.83	...	2.16	...	3.63
Departure from normal .....	...	-1.86	...	+2.17	...	-1.85	...	+2.75	...	+2.66	...	-1.96	...	+0.19	...	+0.12
Clarksville	11	.49	8	.28	1	.10	8	.24	3	.29	20	.14	7	1.30	1	.25
	17	.36	9	.93	2	.47	16	.66	12	.77	29	.16	22	.10	8	.12
	18	.10	13	.15	6	.21	18	.82	14	1.71	...	.23	.21	...	...	...
	21	.62	19	.47	7	.11	19	.48	15	.14	...	...	...	...	...	...
	...	.27	.23	.8	...	.47	24	.43	16	1.04	...	...	...	...	...	...
	...	.28	.63	.22	.19	.25	...	1.27	20	.16	...	...	...	...	...	...
	...	.30	.45	.24	.26	...	...	.25	.23	...	...	...	...	...	...	...
	...	.31	.23	.28	.47	...	...	.26	.19	...	...	...	...	...	...	...
	...	...	...	.29	.25	...	...	.27	.41	...	...	...	...	...	...	...
Total rainfall.....	...	1.77	...	3.49	...	2.80	...	3.99	...	5.17	...	0.42	...	1.67	...	5.37
Departure from normal .....	...	-1.85	...	-0.16	...	-1.33	...	+0.76	...	+1.59	...	-1.94	...	-0.24	...	+1.51
Camp Dennison.....	11	.53	8	.50	1	.10	3	.35	3	1.62	3	.30	7	1.12	1	.17
	17	.45	9	1.46	6	.54	8	.25	12	.20	20	.22	23	.42	8	.10
	...	.18	...	2.17	14	.11	16	.14	14	.13	...	...	...	...	...	...
	...	.19	.30	.26	.28	.17	...	.30	16	.53	...	...	...	...	...	...
	...	.21	.20	.28	.23	.18	...	1.09	20	.11	...	...	...	...	...	...
	...	.28	1.17	...	...	.19	...	.39	23	.36	...	...	...	...	...	...
	...	.30	.24	...	...	.22	...	.15	24	.31	...	...	...	...	...	...
	...	.31	.22	...	...	.25	...	1.50	25	.48	...	...	...	...	...	...
	...	...	...	...	...	.29	...	.14	26	.12	...	...	...	...	...	...
	...	...	...	...	...	...	...	.27	.17	...	...	...	...	...	...	...
Total rainfall.....	...	1.37	...	6.39	...	1.49	...	4.43	...	4.18	...	0.68	...	1.72	...	5.39
Departure from normal .....	...	-1.86	...	+2.95	...	-1.66	...	+1.15	...	+1.56	...	-1.17	...	+0.19	...	+1.63

EAST FORK OF LITTLE MIAMI RIVER.

Station.	April.	Rain.	May.	Rain.	June.	Rain.	July.	Rain.	August.	Rain.	September.	Rain.	October.	Rain.	November.	Rain.
*Hillsboro	2	.12	8	.32	1	.16	3	.26	3	.18	3	1.20	7	.35	1	.22
	11	.37	9	.83	7	.25	8	.60	12	.69	20	.30	22	.46	8	.15
	17	.55	18	.40	14	.34	16	.80	16	1.50	29	.45	23	.94	...	...
	21	.10	19	.25	22	.13	17	.84	17	.15	...	...	...	...	...	...
	...	.28	...	.85	25	.58	18	1.09	20	.30	...	...	...	...	...	...
	...	...	20	.17	26	.54	22	.38	26	.67	...	...	...	...	...	...
	...	...	...	...	28	.25	25	.57	...	...	...	...	...	...	...	...
	...	...	...	...	29	.27	...	...	...	...	...	...	...	...	...	...
Total rainfall.....	...	1.27	...	2.92	...	2.35	...	4.82	...	3.64	...	2.11	...	1.75	...	5.80
Departure from normal .....	...	-1.06	...	+0.08	...	-0.80	...	+1.01	...	+0.61	...	+0.02	...	+0.17	...	+2.42
*New Richmond.....	11	.56	6	.10	1	.12	3	.10	3	2.37	16	.11	7	1.82	1	.18
	17	.53	8	.21	7	.25	6	.17	12	.22	20	.14	23	.27	8	.10
	20	.13	9	.91	22	.30	8	.36	13	.16	29	.43	...	...	...	...
	...	...	19	.57	30	.13	16	.40	14	.20	...	...	...	...	...	...
	...	...	28	.65	...	...	18	.17	16	.15	...	...	...	...	...	...
	...	...	...	...	...	...	19	.12	22	.32	...	...	...	...	...	...
	...	...	30	.30	...	...	21	.12	26	1.24	...	...	...	...	...	...
	...	...	31	.31	...	...	22	.34	27	.27	...	...	...	...	...	...
	...	...	...	...	...	...	25	1.15	...	...	...	...	...	...	...	...
	...	...	...	...	...	...	20	.20	...	...	...	...	...	...	...	...
Total rainfall.....	...	1.36	...	3.87	...	1.05	...	3.15	...	5.03	...	0.82	...	2.24	...	5.78
Departure from normal .....	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
Average rainfall for the basin .....	...	1.64	...	3.64	...	2.10	...	4.52	...	4.35	...	1.40	...	1.98	...	5.11
Departure from normal for basin .....	...	-1.46	...	+0.30	...	-1.10	...	+1.08	...	+1.39	...	-0.89	...	+0.19	...	+1.39

GREAT MIAMI BASIN.

a. STILLWATER RIVER.

Greenville	11	.50	8	.34	1	1.57	2	.11	2	.36	20	.43	6	.60	1	.26
	16	.10	9	.35	21	.20	7	.18	3	.45	27	.87	7	1.05	...	...
	17	1.17	18	.60	22	.42	8	.23	12	.20	29	2.35	22	.35	...	...
	...	...	19	.62	24	.29	12	.13	14	.18	...	...	...	...	...	...
	...	...	27	.23	25	.92	16	.25	15	.84	...	...	...	...	...	...
	...	...	28	.52	29	.42	17	.50	16	.47	...	...	...	...	...	...
	...	...	29	.17	...	...	19	.31	20	.18	...	...	...	...	...	...
	...	...	31	.98	...	...	23	.15	21	.24	...	...	...	...	...	...
	...	...	...	...	...	...	24	.11	...	...	...	...	...	...	...	...
	...	...	...	...	...	...	25	.33	...	...	...	...	...	...	...	...
	...	...	...	...	...	...	29	.87	...	...	...	...	...	...	...	...
Total rainfall.....	...	1.90	...	3.87	...	4.09	...	3.61	...	3.13	...	3.65	...	2.03	...	3.52
Departure from normal .....	...	-1.43	...	-0.34	...	-0.12	...	+0.60	...	-0.41	...	+0.91	...	+0.27	...	-0.33

b. MAD RIVER.

Urbana	11	.64	9	.57	1	.76	7	.40	3	.11	3	.10	7	1.40	1	.20
	13	.10	18	.86	6	.15	11	.31	15	.35	6	.93	22	.15	...	...
	16	.11	27	.36	7	.56	16	.30	16	.83	28	.39	23	.44	...	...
	17	.57	28	.20	21	1.04	17	1.00	19	.25	29	.92	...	...	...	...
	21	.45	31	.82	22	.79	19	.10	20	.13	...	...	...	...	...	...
	22	.15	...	...	29	.53	25	.22	21	.27	...	...	...	...	...	...
	...	...	...	...	...	...	...	...	23	.40	...	...	...	...	...	...
	...	...	...	...	...	...	...	...	25	.75	...	...	...	...	...	...
	...	...	...	...	...	...	...	...	25	.75	...	...	...	...	...	...
	...	...	...	...	...	...	...	...	26	.15	...	...	...	...	...	...
Total rainfall.....	...	2.02	...	2.36	...	4.00	...	2.42	...	3.33	...	2.39	...	1.99	...	3.68
Departure from normal .....	...	0.00	...	-1.04	...	+0.77	...	-2.57	...	+0.95	...	-0.82	...	+0.18	...	-0.11

*Hillsboro and New Richmond are situated just outside of the watershed of the Little Miami River, but use is made of the data from these stations as there was no weather bureau station on the territory drained by the East Fork of Little Miami River.

b. MAD RIVER — Concluded.

Station.	April.	Rain.	May.	Rain.	June.	Rain.	July.	Rain.	August.	Rain.	September.	Rain.	October.	Rain.	November.	Rain.
*Springfield	11	.54	8	.65	1	.32	8	.33	15	.36	3	.15	6	.30	1	.23
	17	.57	9	.28	2	.34	12	.43	16	1.02	7	.24	7	.80	...	...
	21	.63	18	1.36	6	.11	16	.14	20	.59	27	1.01	23	.41	...	...
	22	.13	19	.13	21	.72	18	.93	21	.64	29	.62	...	...	...	...
	...	...	31	.26	22	.29	19	1.31	24	.80	...	...	...	...	...	...
	...	...	...	...	24	1.43	25	.24	26	.16	...	...	...	...	...	...
	...	...	...	...	25	.23	30	.15	27	.25	...	...	...	...	...	...
	...	...	...	...	29	.44	...	...	...	...	...	...	...	...	...	...
Total rainfall.....	...	2.00	...	2.89	...	4.06	...	3.72	...	3.88	...	2.10	...	1.64	...	3.50
Departure from normal .....	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...

c. GREAT MIAMI RIVER.

Bellefontaine	12	1.65	...	...	1	.30	8	.45	3	.10	4	.20	7	2.05	...	...
	14	.10	...	...	2	.50	12	1.10	16	1.00	7	.11	16	.10	...	...
	18	.71	...	...	7	.17	17	.17	20	.35	21	.70	23	.63	...	...
	22	.25	...	...	8	.50	18	.43	21	.45	28	.20	...	...	...	...
	...	...	...	...	9	.26	20	.28	24	1.20	29	1.30	...	...	...	...
	...	...	...	...	22	.55	25	.98	26	.23	...	...	...	...	...	...
	...	...	...	...	23	1.05	30	.18	27	.10	...	...	...	...	...	...
	...	...	...	...	25	2.10	...	...	...	...	...	...	...	...	...	...
	...	...	...	...	30	.22	...	...	...	...	...	...	...	...	...	...
Total rainfall.....	...	2.78	...	...	...	5.65	...	3.76	...	3.43	...	2.64	...	2.78	...	2.75
Departure from normal .....	...	+0.09	...	...	...	+1.93	...	+0.92	...	+0.92	...	-0.18	...	+0.38	...	-1.08
Rosewood	1	.24	8	.21	1	.47	...	...	3	.22	3	.16	6	.19	1	.18
	11	.63	9	.23	2	.11	...	...	15	.67	6	.41	7	2.01	...	...
	13	.13	18	.60	9	.16	...	...	16	1.40	8	.45	22	.51	...	...
	16	.10	19	.11	10	.24	...	...	20	.48	30	.45	30	.22	...	...
	17	.83	25	.11	21	.45	...	...	21	.55	27	.34	...	...	...	...
	21	.11	27	.26	22	.26	...	...	23	.49	28	.25	...	...	...	...
	...	...	28	.15	24	.63	...	...	25	.52	29	1.35	...	...	...	...
	...	...	29	.14	29	.18	...	...	26	.20	...	...	...	...	...	...
	...	...	31	.21	...	...	...	...	27	.30	...	...	...	...	...	...
Total rainfall.....	...	2.04	...	2.02	...	2.56	...	...	4.91	...	3.41	...	3.01	...	3.54	...
Departure from normal .....	...	-0.46	...	-1.22	...	+0.16	...	...	+1.95	...	+0.73	...	+1.24	...	-0.30	...
Sidney	12	.65	9	.38	1	.37	8	.40	3	.25	7	.17	7	3.10	...	...
	17	.12	19	.74	2	.65	17	.57	13	.21	9	.35	8	.37	...	...
	18	.65	28	.36	6	.19	18	.52	15	1.11	21	.23	17	.12	...	...
	22	.14	29	.35	7	.55	20	.21	20	.54	28	.49	23	1.48	...	...
	...	...	...	...	21	.31	21	.21	21	.64	29	1.17	31	.10	...	...
	...	...	...	...	22	.35	25	.45	24	.38	...	...	...	...	...	...
	...	...	...	...	24	.58	...	...	25	.14	...	...	...	...	...	...
	...	...	...	...	26	.12	...	...	27	.49	...	...	...	...	...	...
Total rainfall.....	...	1.80	...	1.90	...	3.82	...	2.70	...	3.98	...	2.53	...	5.21	...	3.08
Departure from normal .....	...	...	...	...	...	...	...	...	...	...	...	+0.27	...	...	...	...
Dayton	11	.70	8	.49	1	.34	8	.40	2	.13	3	.19	6	.98	1	.18
	17	.30	9	.33	2	.16	12	.21	3	.52	9	.16	7	1.45	...	...
	...	...	18	.43	6	.58	16	.42	14	.18	20	.13	22	.15	...	...
	...	...	19	.37	14	.10	18	.39	15	.50	27	.11	23	.70	...	...
	...	...	24	.11	21	.34	19	.74	16	1.35	29	.38	...	...	...	...
	...	...	24	.43	22	.88	20	.11	...	...	...	...	...	...	...	...
	...	...	25	.53	25	.51	23	.17	...	...	...	...	...	...	...	...
	...	...	27	.43	24	.43	22	.88	20	.11	...	...	...	...	...	...
	...	...	28	.27	25	.53	25	.51	23	.17	...	...	...	...	...	...
	...	...	31	.33	26	.50	...	...	25	1.17	...	...	...	...	...	...
	...	...	...	...	29	.86	...	...	26	.16	...	...	...	...	...	...
	...	...	...	...	...	...	...	...	27	.16	...	...	...	...	...	...
Total rainfall.....	...	1.23	...	2.79	...	3.96	...	3.81	...	4.56	...	0.99	...	3.35	...	3.60
Departure from normal .....	...	-1.70	...	-1.05	...	0.00	...	+0.89	...	+1.62	...	-1.71	...	+1.32	...	+0.21

* The record of precipitation at Springfield was obtained from Mr. W. C. Powell, chief engineer of waterworks, and was kindly furnished to us from his private record-book.

c. GREAT MIAMI RIVER—Concluded.

Station.	April.	Rain.	May.	Rain.	June.	Rain.	July.	Rain.	August.	Rain.	September.	Rain.	October.	Rain.	November.	Rain.
New Paris.....	11	.84	8	.16	1	1.61	2	.36	2	.30	20	.24	6	.10	1	.70
	16	.10	9	.45	6	.22	8	.80	3	.16	27	.35	7	1.25	...	...
	17	.51	18	.58	14	.42	12	.55	12	.12	29	.45	23	.22	...	...
	22	.14	19	.89	21	1.02	16	.62	14	.29	...	...	...	...	...	...
	...	.23	.33	.22	.26	.17	.44	.15	1.11	...	...	...	...	...	...	...
	...	.27	1.30	24	1.07	18	.33	.16	.21	...	...	...	...	...	...	...
	...	.28	.61	.25	.75	.19	.60	.20	.34	...	...	...	...	...	...	...
	...	.29	.58	.26	.53	.20	.22	.25	.80	...	...	...	...	...	...	...
	...	.31	.70	.29	.67	.25	.50	...	...	...	...	...	...	...	...	...
	...	...	...	...	...	.29	.58	...	...	...	...	...	...	...	...	...
Total rainfall .....	...	1.65	...	5.71	...	6.64	...	5.08	...	3.38	...	1.04	...	1.57	...	3.75
Departure from normal .....	...	-0.54	...	+3.04	...	+2.92	...	+2.83	...	-0.61	...	-1.93	...	-0.12	...	-1.00
Springboro	11	.46	8	1.40	2	.25	2	.50	3	.79	2	.60	5	.99	2	.25
	14	.30	18	.22	7	.58	3	.11	13	1.10	20	.20	6	1.06	...	...
	16	.80	19	.48	16	.22	8	.47	14	1.45	29	.20	21	.50	...	...
	17	.32	28	.98	24	.22	16	.35	20	.20	...	.22	...	.59	...	...
	20	.30	29	.16	29	1.51	17	1.99	22	.15	...	.30	...	.64	...	...
	...	...	.31	.41	.30	.33	.19	1.10	.25	1.18	...	...	...	...	...	...
	...	...	...	...	...	...	.24	.10	.26	.18	...	...	...	...	...	...
	...	...	...	...	...	...	.25	.96	...	...	...	...	...	...	...	...
Total rainfall .....	...	2.18	...	3.68	...	3.11	...	5.58	...	5.05	...	1.00	...	3.69	...	3.53
Departure from normal .....	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
Jacksonboro	11	.60	9	.85	1	.50	2	.25	3	.75	3	.25	7	1.25	1	.15
	17	1.00	19	.50	6	.25	5	.10	12	.19	6	.10	22	.40	...	...
	22	.10	27	1.00	14	.15	7	.40	13	.10	8	...	30	.40	...	...
	...	.28	.10	.21	.15	.11	.10	.14	.10	...	...	...	...	...	...	...
	...	.29	1.00	.22	.15	.16	.25	.16	.40	...	...	...	...	...	...	...
	...	.30	.25	.24	.10	.17	.20	.20	.15	...	...	...	...	...	...	...
	...	.31	.19	.25	.50	.18	.75	.25	1.00	...	...	...	...	...	...	...
	...	...	...	.28	.75	.19	.10	.26	.25	...	...	...	...	...	...	...
	...	...	...	...	...	.24	1.00	...	...	...	...	...	...	...	...	...
Total rainfall .....	...	1.75	...	3.80	...	2.55	...	3.40	...	2.90	...	0.45	...	2.05	...	2.75
Departure from normal .....	...	-1.07	...	+1.02	...	-1.10	...	+1.23	...	+0.16	...	-1.95	...	+0.50	...	-0.56
Bethany	11	.48	8	.65	1	.42	2	.25	3	1.54	3	.14	6	.48	1	.25
	16	.16	18	.26	6	1.34	4	.23	12	.14	7	.10	7	.95	...	...
	17	.45	19	.34	7	.78	6	.12	14	.60	29	.44	22	.54	...	...
	18	.14	27	1.96	14	.27	7	.22	15	.36	...	...	...	...	...	...
	...	.28	.30	.15	.37	.16	.52	.23	.65	...	...	...	...	...	...	...
	...	.29	.40	.24	1.04	.17	1.22	.25	.63	...	...	...	...	...	...	...
	...	.30	.26	.26	.16	.18	.17	.26	.19	...	...	...	...	...	...	...
	...	.31	.25	.28	.33	.19	.35	...	...	...	...	...	...	...	...	...
	...	...	...	.29	.10	.23	.97	...	...	...	...	...	...	...	...	...
Total rainfall .....	...	1.33	...	4.48	...	4.94	...	4.24	...	4.02	...	0.81	...	1.97	...	4.47
Departure from normal .....	...	-1.40	...	+0.99	...	+1.99	...	+0.07	...	+0.97	...	-1.57	...	+0.53	...	+1.00
Average rainfall for basin .....	...	1.88	...	3.35	...	4.13	...	3.83	...	3.87	...	1.91	...	2.66	...	3.49
Departure from normal for basin .....	...	-0.82	...	+0.20	...	+0.82	...	+0.57	...	+0.69	...	-0.69	...	+0.54	...	-0.27

The following general statements were also gathered from the monthly reports of the weather bureau:

April. The temperature for the month was nearly normal, the average departure being but -0.5° F. for the state. However, the month was dry, as the average deficiency in rainfall was 1.01 inches

(1.67 inches for the southern section of the state). Very little rain fell during the first ten days of April and only traces after the 23rd.

May. The average temperature for the month was 1.9° F. above the normal. The average deficiency in rainfall for the state was 1.07 inches, but the deficiency for the southern section was only .06 inches, and that of the middle section 1.75 inches. The last ten days of the month were warm and general rains occurred from the twenty-seventh on.

June. The average temperature was 0.5° F. below the normal. The average rainfall showed a deficiency of .42 inches for the state, and deficiencies of .16 and .61 inches respectively for the middle and southern sections.

July. The temperature showed an excess of $.4^{\circ}$ F. The excess of rainfall for the state was .73 inches, but the middle and southern sections showed deficiencies of .45 and .12 inches, respectively.

August. The month was hot and rather wet. This was the hottest August save one for eighteen years. The average excess of temperature was 5.0° F. The departures from the normal rainfall were $+ .77$, $+ .95$ and $+ .36$ inches, respectively, for the state, the middle section, and the southern section.

September. This month was hot and dry. In the last eighteen years only one September has shown a higher mean daily temperature. The departures from the normal temperature were $+ 3.7$ and $+ 4.5$ for the state and the southern section of the state. The coolest spell in the month was from the 17th to the 19th. The rainfall departures from the normal were $-.88$, $-.63$ and -1.24 inches for the state, the middle and the southern sections.

October. The average excess of temperature was 8.0° F. The mean daily temperature for the state during the month was 2.4° higher than for any other October in the past eighteen years. The rainfall showed departures of $-.22$, $-.05$, and $-.40$ inches for the state, the middle and the southern sections. Thus it is seen the month was a warm one for the time of year and drier than usual.

November. The excess of temperature was 1.0° , and that of precipitation .86 inches, but as only light rains fell on the 1st, 7th, and 8th, while the heavier ones did not begin until the 20th, that portion of the month concerned in this study was dry for November.

WEATHER HISTORY OF SAMPLES.

From the preceding rainfall table and general statements, we derive the following weather history of the various samples taken.

a.—LITTLE MIAMI RIVER.

April. Samples were taken on the 24th, 25th, and 26th of the month during a period of fair weather. While the rainfall for the month was

deficient, the most of it occurred between the 11th and 22d, and thus the samples do not follow an unusual April period.

May. Samples were taken on the 28th and 29th. (The Batavia samples were taken June 1st). This had been a rather dry May until the general rain covering the last five days of the month. Therefore the samples were taken in a warm period and during the rainiest portion of the month.

June. These collections were made on the 26th-28th of the month, during a period of general rains of light to medium intensity. There was a small deficiency in the precipitation for the month, but the rain was fairly well distributed.

July. Samples were collected July 17, 19 and 20. The sampling occurred during one (and the heavier one) of the two periods of general soaking rains of the month. The weather bureau stations on the Little Miami watershed, as shown in the rainfall table, recorded daily precipitations from light rains to as heavy as 2.08 inches. Previous to the 16th of the month there had been a few days of bright clear weather.

August. Collections were made on the 20th-22d of the month, during a wet hot period. Showers had been frequent since the 11th of the month. The samples from the southern portion of the watershed represent the stream at it was returning to normal, after a summer flood.

September. Samples were taken September 17-19. The month of September showed the least rainfall for the watershed of any month during our studies on the Little Miami River, and as the precipitation occurred chiefly on the 3d and 6th, and after the 19th, the samples represent the streams after a hot dry period in the early fall.

October. Samples were taken October 13th, 18th and 19th. In this unusually hot October the rainfall was deficient, and as the precipitation on the area drained by the Little Miami River fell chiefly on the 7th, 22d and 23d of the month, these samples represent the water during another period of hot dry weather in the fall.

November. Samples were taken on the 7th to the 9th of the month. The cold fall rains did not begin until later, and as only very light rains fell on this watershed on the 1st and 8th, and also on October 30th, the samples were taken after two weeks of warm fair weather in the late fall.

b.—GREAT MIAMI RIVER.

As there were twenty-two sampling stations on this watershed it was found more convenient to make part of the collections at the same time with the Little Miami samples. Accordingly the samples from the southern portion of the watershed were collected on a different trip each month than those from the northern portion. In speaking of the southern samples reference is made to those from Middletown, Hamilton and Cleves, while by the northern samples those are designated which come from

Dayton and points farther north, viz.: Troy, Piqua, Sidney, Greenville, Springfield and Urbana.

April. The northern samples were taken April 16-19; the southern April 25-26. The early portion of the month was dry, but beginning on the 11th frequent showers occurred on the watershed up to and including the 22d, after which the weather was fair. The heaviest rain of the month fell on or near the 17th, one of the sampling days. The streams were somewhat disturbed by surface washings at the first sampling period.

May. The northern samples were collected May 22-24; the southern on the 28th and 29th. The collections of the former trip were made during a fair weather period preceding a few days by moderate rains. From the 27th to the 29th there was a general rain on the watershed and as a result the southern samples showed disturbances.

June. Northern collections, June 18-20. Southern collections June 27-28. Light to moderate rains fell during the early part of the month, but after the 9th no rain of moment fell on the area affecting the northern samples, and accordingly they represent the streams after a period of dry clear weather in the early summer. Although no rain fell during the second sampling period, yet the southern samples showed the influence of the light, moderate and heavy rains which had fallen during the six days previous to this trip.

July. Northern samples were taken July 9-11; the southern July 19-20. The first set of collections represent no unusual conditions, but those of the second set (southern samples) showed some disturbances, as rains were general from the 16th to the 19th of the month, and one day's precipitation was recorded as high as 2 inches.

August. Sampling periods were on the 7th-9th, for the north, and 21st-22d for the south. In general only very light rains fell at the opening of the month, otherwise the first ten days were dry. Accordingly the earlier samples represented the northern streams during a fair weather period of unusual heat. Rains of varying intensities fell in the interval between the two sampling periods, and the later samples do not stand for as dry conditions, although the weather was still hot.

September. The northern samples were taken on the 3rd, 4th, and 5th of the month, the southern samples on the 18th and 19th. Very light rains were recorded at some stations on the 3d, but the northern samples represented fair weather samples after a week of hot clear weather. The southern collections were made during the coolest period of the month, and after a fair weather period of about three weeks, in which time the only rainfall of moment was recorded at Urbana on the 6th.

October. Samples for the northern section were taken on the first three days of the month; the southern ones on the 13th. In both cases the weather was fair at the time of sampling, but heavy rains had fallen on the 7th of October, as well as during the last week of September, and therefore the October samples revealed the character of the water in mild fall weather from three to six days after heavy rains.

November. Northern sampling period November 1-3. Southern sampling period November 7-8. As the fall rains began later, and only a very light rain fell on the 1st or 2d, these samples represent warm dry weather conditions for the season of year.

VI. RESULTS OF EXAMINATIONS.

The analytical results obtained from the examinations of the samples taken monthly from April to November, 1900, inclusive, are given first in tabulated form and later by plotted curves. In the table, the first column gives the laboratory number of the sample; the second, the serial number of the sample as collected; the third, the approximate distance in miles by river from the station to the mouth of the Little Miami River or the Great Miami River, as the case may be; the fourth, the locality or source of sample; the fifth, the date of collection; and the remaining columns give the analytical findings which are expressed in parts per million, except for color, turbidity, bacteria and temperature. The color is expressed in terms of the cobalt-platinum standard; the turbidity in terms of the platinum wire scale; the bacteria in number per cubic centimeter of the water; and the temperature in degrees Centigrade.

The abbreviations used for designating the amount of sediment are as follows: Very slight, v. s.; slight, s.; considerable, c.; much, m.

Turbidity readings marked *, indicate that the end of the turbidity stick rested on the bed of the river with the wire still plainly visible. When the number of bacteria is marked *, it indicates the count was low owing to interference from overspreading growths.

RECORD OF CHEMICAL AND BACTERIOLOGICAL EXAMINATIONS

LITTLE MIAMI WATERSHED.

α LITTLE MIAMI RIVER.

[Parts per

Sample number.	Serial number.	Approximate distances.	Locality of sample.	Date collected.	Color.	Turbidity.	Sediment.	Odor.
.....	.....	90	South Charleston,	April	.....	.....	.....	Not taken.
1128	46	.....	above	May 28	.26	.13	S.	Earthy.
1196	75	.....	"	June 26	.40	.34	C.	Vegetative.
1234	107	.....	"	July 17	.30	.30	C.	"
1288	133	.....	"	Aug. 20	.30	.31	C.	Earthy.
1436	196	.....	"	Oct. 18	.23	.24	C.	Water not fl'g.
1485	219	.....	"	Nov. 7	.29	.25	C.	Vegetative.
								Veg., earthy.
			AVERAGE	.....	.30	.26	.....	.....
1071	27	69	Xenia, above town.	April 26	.20	.12	S.	Vegetative.
1126	47	.....	"	May 28	.28	.20	C.	"
1202	85	.....	"	June 28	.33	.40	C.	"
1236	105	.....	"	July 17	.30	.34	C.	Marked veg.
1310	143	.....	"	Aug. 22	.43	.27	C.	Vegetative.
1358	162	.....	"	Sept. 17	.16	.14	S.	"
1437	197	.....	"	Oct. 18	.35	.13	C.	Faint musty.
1502	230	.....	"	Nov. 9	.65	.08	S.	Vegetative.
			AVERAGE	.....	.34	.21	.....	.....
1072	28	68	Xenia, below town.	April 26	.26	.12	S.	Marked veg.
1127	48	.....	"	May 28	.32	.22	C.	Vegetative.
1203	86	.....	"	June 28	.33	.40	C.	"
1235	104	.....	"	July 17	.28	.26	C.	Marked veg.
1311	144	.....	"	Aug. 22	.38	.23	C.	Vegetative.
1359	163	.....	"	Sept. 17	.17	.15	S.	"
1438	198	.....	"	Oct. 18	.33	.14	C.	Faint musty.
1501	229	.....	"	Nov. 9	.58	.10	S.	Vegetative.
			AVERAGE	.....	.33	.20	.....	.....
1062	18	20	Loveland, above town	April 24	.18	.11	C.	Marked veg.
1131	55	.....	"	May 29	.30	.75	M.	Earthy.
1197	76	.....	"	June 26	.15	.52	C.	Faint sour.
1233	106	.....	"	July 17	.13	.50	C.	Vegetative.
1289	134	.....	"	Aug. 20	.33	1.05	C.	Earthy, veg.
1360	164	.....	"	Sept. 17	.20	.26	C.	Earthy.
1439	199	.....	"	Oct. 19	.18	.23	C.	Vegetative.
1498	228	.....	"	Nov. 9	.26	.16	S.	Earthy.
			AVERAGE	.....	.22	.45	.....	.....

OF THE GREAT AND LITTLE MIAMI RIVERS AND TRIBUTARIES.

LITTLE MIAMI WATERSHED.

Million.)

a LITTLE MIAMI RIVER.

Oxygen required.	Nitrogen as				Chlorine	Alkalinity.	Increasing constituents.	Total solids.	Loss on ignition.	Dissolved oxygen.	Bacteria per c. c.	Temperature °C.
	Albuminoid ammonia.	Free ammonia.	Nitrites.	Nitrates.								
5.04	.200	.138	.042	1.24	T	225.8	66.0	354	134	6.10	3800	18.0
9.15	.442	.262	.090	.66	T	239.4	39.8	390	125	4.90	2200	24.5
9.81	.522	.230	.022	.06	1.5	290.2	7.4	438	181	5.33	3800	28.0
9.98	.540	.156	.018	T	None	221.8	36.2	349	98	3.20	2800	24.5
4.98	.242	.080	.013	None	None	223.2	None	362	128	9.00	3400	8.0
5.86	.356	.112	.018	None	4.0	266.8	None	423	123	8.75	3000	8.0
7.47	.384	.163	.034	.33	.9	244.5	24.9	386	132	6.21	3266	.....
4.89	.220	.032	.028	1.17	1.1	223.8	18.4	335	127	11.50	44400	18.0
5.83	.270	.230	.034	.70	.5	234.8	27.8	396	152	6.03	121100	20.0
6.29	.314	.174	.038	.67	.8	250.8	None	423	119	6.17	4900	25.0
8.31	.794	.280	.056	.03	.7	260.8	None	374	155	11.00	1700	27.0
6.11	.296	.090	.030	.02	T	230.2	22.2	369	118	5.73	174200	26.5
3.71	.226	.066	.012	.06	1.4	235.8	None	315	114	8.25	3200	18.5
8.50	.302	.136	.007	T	.8	269.8	None	386	153	8.30	180000	12.5
8.89	.306	.006	.008	.12	1.9	287.2	None	368	127	8.80	80000	6.0
6.57	.341	.127	.027	.35	.9	249.1	8.5	371	133	8.22	76187	.....
6.19	.286	.020	.032	1.28	1.6	240.2	13.8	362	145	9.70	62400	18.0
5.53	.292	.310	.058	.89	4.3	254.4	7.0	418	165	5.40	11800	20.0
5.49	.328	.180	.036	1.04	2.2	221.6	32.2	383	108	6.21	5100	25.5
5.55	.314	.142	.032	.36	3.2	256.6	None	375	154	9.21	1200	26.5
7.33	.462	.070	.030	T	.8	236.8	None	344	118	6.22	177000	27.5
4.20	.282	.078	.022	T	1.9	242.4	None	388	113	8.90	2600	19.5
6.64	.212	.134	.009	T	1.7	252.4	None	380	145	7.60	34400	12.5
7.01	.324	.050	.010	.10	2.6	281.0	None	378	121	8.72	148000	6.5
5.99	.312	.123	.029	.46	2.3	248.2	6.6	378	134	7.74	55312	.....
4.13	.216	.036	.011	1.26	1.1	194.2	20.2	316	122	9.70	1800	17.0
7.02	.332	.076	.018	.52	.8	157.6	15.2	483	91	7.62	21000	22.0
5.05	.324	.096	.009	.40	2.2	238.8	12.4	389	64	8.30	1500	28.5
4.11	.254	.066	.026	.30	2.6	219.6	11.2	350	117	7.82	1200	29.0
7.13	.312	.124	.024	.31	None	128.2	20.6	338	65	6.57	8000	29.5
4.61	.321	.036	.006	None	2.8	210.0	None	316	60	9.90	1900	20.0
3.62	.220	.032	.006	None	2.9	224.0	None	378	119	9.50	2100	13.0
2.79	.176	.022	.010	T	2.7	231.2	None	343	118	10.40	1400	6.5
4.81	.269	.061	.014	.35	1.9	200.4	9.9	364	94	8.73	4862	.....

RECORD OF CHEMICAL AND BACTERIOLOGICAL EXAMINATIONS OF

a LITTLE MIAMI RIVER—Concluded.

(Parts Per

Sample number.	Serial number.	Approximate distances.	Locality of sample.	Date collected.	Color.	Turbidity.	Sediment.	Odor.
1063	19	3	Linwood, below t'n	April 24	.13	.10	C.	Vegetative.
1134	54	....	"	May 29	.25	5.20	M.	Earthy.
1198	77	....	"	June 26	.23	.42	C.	Vegetative.
1244	112	....	"	July 19	.25	7.00	M.	Earthy.
1294	135	....	"	Aug. 20	.23	1.20	C.	"
1368	166	....	"	Sept. 18	.22	.30	S.	Earthy, veg.
1432	195	....	"	Oct. 13	.32	.45	C.	Earthy.
1495	224	....	"	Nov. 8	.17	.11	S.	Earthy.
AVERAGE ....				.....	.22	1.85	.....	.....

b. EAST FORK OF LITTLE MIAMI RIVER.

1064	20	25	Batavia, above town	April 25	.25	.17	C.	Faint earthy.
1136	57	....	"	June 1	.33	.24	C.	Vegetative.
1199	78	....	"	June 27	.25	.18	S.	"
1246	114	....	"	July 20	.25	.22	C.	Sour.
1297	137	....	"	Aug. 21	.28	1.14	C.	Earthy.
1370	168	....	"	Sept. 19	.23	.28	S.	Vegetative.
1443	200	....	"	Oct. 19	.28	.38	C.	"
1500	225	....	"	Nov. 8	.28	.18	S.	Faint veg've.
AVERAGE ....				.....	.27	.35	.....	.....

1065	21	23	Batavia, below t'n.	April 25	.25	.16	C.	Faint earthy.
1137	....	....	"	June 1	.33	.24	C.	Vegetative.
1200	79	....	"	June 27	.28	.18	S.	"
1245	113	....	"	July 20	.25	.20	C.	"
1296	136	....	"	Aug. 21	.28	1.12	C.	Earthy.
1369	167	....	"	Sept. 19	.23	.27	S.	Vegetative.
1444	201	....	"	Oct. 19	.32	.38	C.	"
1496	226	....	"	Nov. 8	.25	.17	S.	Faint musty.
AVERAGE ....				.....	.27	.34	.....	.....

GREAT AND LITTLE MIAMI RIVERS AND TRIBUTARIES — Continued.

Million.

a LITTLE MIAMI RIVER — Concluded.

Oxygen required.	Nitrogen as				Chlorine.	Alkalinity.	Incrusting constituents.	Total solids.	Loss on ignition.	Dissolved oxygen.	Bacteria per c. c.	Temperature °C.
	Albuminoid ammonia.	Free ammonia.	Nitrites.	Nitrates.								
3.73	.192	.042	.010	.57	2.6	190.6	19.4	308	119	10.65	6100	18.5
14.75	.638	.097	.010	.18	.5	106.6	26.4	1529	149	8.03	30000	21.5
4.13	.260	.118	.006	.08	3.2	212.8	3.0	345	92	8.05	3000	28.0
19.66	.658	.134	.014	.10	1.3	127.6	25.2	1913	183	6.50	43000	27.5
6.45	.246	.068	.022	.10	T	108.2	None	352	62	6.70	7300	30.0
4.20	.370	.076	.006	T	3.4	205.8	None	326	59	10.89	1300	21.5
4.72	.302	.054	.006	T	3.1	161.6	None	356	100	9.85	3900	17.5
2.79	.202	.026	T	.04	4.1	229.2	8.6	302	63	9.75	1200	9.0
7.55	.358	.077	.009	.13	2.3	167.8	10.3	679	103	8.80	11975	.....

b. EAST FORK OF LITTLE MIAMI RIVER.

6.72	.300	.044	.001	.03	2.1	154.8	39.0	270	89	8.00	3200	17.0
6.95	.372	.018	.006	.14	.5	160.8	42.0	258	100	.....	.....	.....
5.43	.296	.148	.002	.12	.5	149.4	23.4	257	83	6.30	750	26.0
5.54	.310	.118	.010	.04	T	167.6	None	251	76	6.30	2100	27.0
6.54	.332	.086	.012	T	None	80.0	None	307	52	6.58	39900	27.5
5.28	.398	.060	.003	None	1.1	135.4	50.2	238	39	7.05	2300	18.5
5.97	.268	.035	.003	None	2.2	111.4	10.2	251	76	10.90	5400	16.0
5.32	.330	.034	.002	.08	4.6	121.8	6.8	233	49	9.55	1500	9.0
5.97	.326	.068	.005	.05	1.4	135.1	21.4	258	71	7.81	7878	.....
6.44	.350	.052	.002	.02	2.4	157.6	63.8	299	98	7.90	3500	17.0
7.15	.348	.032	.007	.16	1.1	161.2	19.4	277	105	.....	.....	.....
5.47	.266	.146	.010	.13	.9	143.2	73.8	261	89	6.85	1300	26.0
5.28	.302	.136	.010	.03	.9	195.2	None	262	84	5.45	2200	27.0
6.87	.314	.104	.013	T	T	80.2	8.2	353	56	5.80	38400	28.0
5.08	.326	.102	.005	None	1.8	139.0	None	246	38	6.62	1500	19.5
6.60	.234	.020	.005	None	3.0	115.0	None	243	70	10.10	6000	16.0
4.37	.276	.034	.002	.04	4.4	124.4	23.2	230	65	9.65	2300	9.0
5.91	.313	.078	.007	.05	1.8	139.5	23.5	271	76	7.48	7886	.....

RECORD OF CHEMICAL AND BACTERIOLOGICAL EXAMINATIONS OF GREAT MIAMI WATERSHED.

a STILLWATER BASIN.

Greenville Creek.

(Parts per

Sample number.	Serial number.	Approximate distances.	Locality of sample.	Date collected.	Color.	Turbidity.	Sediment.	Odor.
1047	8	126	Greenville, above town	April 17	.20	.08	S ₄	Faint veg've.
1112	33	....	"	May 22	.28	.07	S ₄	Vegetative.
1180	62	....	"	June 18	.25	.08	S ₄	"
1217	91	....	"	July 10	.27	.18	S ₄	"
1267	120	....	"	Aug. 7	.22	.17	C.	"
1331	149	....	"	Sept. 3	.23	.14	S ₄	"
1394	178	....	"	Oct. 1	.42	.30	C.	"
1468	206	....	"	Nov. 1	.20	.08	S.	Earthy.
AVERAGE ....				.....	.26	.14	.....	.....
1048	9	124	Greenville, below town	April 17	.25	.18	S.	Sour.
1113	34	....	"	May 22	.25	.11	S.	Vegetative.
1181	63	....	"	June 18	.23	.10	C.	"
1218	92	....	"	July 10	.23	.16	S.	Faint musty.
1268	121	....	"	Aug. 7	.23	.23	C.	Vegetative.
1332	150	....	"	Sept. 3	.21	.17	S.	Vegetative & faint musty.
1393	177	....	"	Oct. 1	.48	.38	C.	Vegetative.
1469	207	....	"	Nov. 1	.30	.08	S.	Earthy.
AVERAGE ....				.....	.27	.18	.....	.....
1054	13	79	Dayton, above town	April 18	.26	.40	C.	Earthy.
1119	38	....	"	May 23	.14	.08	S.	Faint veg've.
1177	67	....	"	June 19	.28	.15	C.	Faint sour.
1221	95	....	"	July 10	.25	.16	V. S.	Vegetative.
1272	125	....	"	Aug. 8	.25	.13	S.	"
1335	153	....	"	Sept. 4	.25	.25	S.	Sour.
1398	182	....	"	Oct. 2	.21	.19	S.	Faint veg've.
1475	211	....	"	Nov. 2	.24	.27	S.	"
AVERAGE ....				.....	.23	.20	.....	.....

GREAT AND LITTLE MIAMI RIVERS AND TRIBUTARIES — Continued.

GREAT MIAMI WATERSHED.

a STILLWATER BASIN.

Million.)

Greenville Creek.

Oxygen required.	Nitrogen as				Chlorine.	Alkalinity.	Increasing constituents.	Total solids.	Loss on ignition.	Dissolved oxygen.	Bacteria per c. c.	Temperature °C.
	Albuminoid ammonia.	Free ammonia.	Nitrites.	Nitrates.								
4.30	.188	.030	.016	3.44	.2	217.8	83.0	449	167	10.34	3300	12.5
4.41	.211	.094	.038	2.09	T	226.2	40.0	380	141	10.45	1100	22.0
4.25	.184	.084	.014	.55	.6	278.4	31.0	467	145	8.95	1300	25.0
5.17	.214	.060	.020	.44	.4	280.0	None	369	75	6.44	1100	20.0
5.15	.268	.134	.011	None	2.7	255.4	3.2	421	147	12.35	2000	31.0
3.77	.186	.096	.010	T	1.0	269.0	None	413	136	8.40	4700	26.0
6.76	.272	.063	.024	2.12	None	189.6	35.0	432	148	8.25	19000	19.0
3.13	.164	.019	.002	T	1.5	274.0	26.6	472	142	9.05	6400	15.5
4.62	.211	.072	.017	1.08	.8	248.8	27.3	425	138	9.28	4862	.....
5.68	.308	.088	.024	3.15	.8	214.2	74.4	474	158	9.54	22000	12.5
4.81	.292	.108	.038	2.35	1.0	235.8	55.2	422	150	10.01	3000	22.0
4.86	.226	.104	.018	.54	2.0	268.4	55.0	535	192	8.83	10400	25.0
5.13	.196	.070	.019	.72	3.0	285.2	8.2	415	102	6.60	2800	20.0
5.15	.227	.102	.022	.16	5.0	270.6	None	483	169	9.60	7600	30.0
4.51	.340	.106	.024	.05	3.9	265.0	9.4	484	160	8.57	7400	26.5
7.43	.394	.094	.020	2.38	1.0	194.6	3.84	521	156	8.00	15000	19.5
4.41	.210	.058	.009	None	3.9	280.0	42.6	464	145	9.90	38000	15.5
5.25	.274	.091	.022	1.17	2.6	251.7	35.4	475	154	8.88	13275	.....
5.93	.284	.020	.015	3.78	.4	187.8	24.0	478	151	8.78	24300	14.0
3.62	.242	.058	.006	.82	1.1	218.2	None	348	122	8.30	1000	21.5
3.94	.182	.030	.010	2.33	1.0	244.0	21.0	434	158	8.83	1300	24.0
5.77	.288	.040	.003	.97	.1	229.2	13.2	361	123	8.80	2100	26.5
3.76	.226	.038	.006	None	.8	223.2	3.2	342	95	7.90	1200	30.0
4.58	.280	.086	.022	.59	.3	221.4	5.2	376	137	8.57	2300	28.0
4.24	.275	.031	T	.03	2.3	231.4	None	381	141	9.70	330000§	21.5
4.20	.234	.024	.014	7.66	1.3	196.0	None	317	103	8.95	3100	15.5
4.50	.251	.041	.009	2.02	.9	218.9	8.3	380	129	8.73	45662	.....

§ Chiefly one species.

RECORD OF CHEMICAL AND BACTERIOLOGICAL EXAMINATIONS OF

δ MAD RIVER BASIN.

Buck Creek.

(Parts per

Sample number.	Serial number.	Approximate distances.	Locality of sample.	Date collected.	Color.	Turbidity.	Sediment.	Odor.
1040	1	103	Springfield, above town	April 16	.10	.05*	S.	None.
1124	45	....	"	May 24	.10	.10	C.†	Vegetative.
1187	72	....	"	June 20	.23	.09	S.	Faint earthy.
1225	99	....	"	July 10	.15	.23	C.	"
1281	132	....	"	Aug. 9	.17	.14	S.	Vegetative.
1343	161	....	"	Sept. 5	.13	.16	S.	"
1406	189	....	"	Oct. 3	.15	.10	S.	Faint veg've.
1484	216	....	"	Nov. 3	.17	.05	V. S.	None.
AVERAGE ....				.....	.15	.11	.....	.....

Mad River.

1057	16	114	Urbana, above town	April 19	.32	.25	C.	Earthy.
1120	41	....	"	May 24	.12	.05	S.	Faint earthy.
1184	71	....	"	June 20	.21	.18	C.	Faint veg've.
1214	88	....	"	July 9	.18	.25	S.	"
1276	128	....	"	Aug. 9	.22	.24	S.	Vegetative.
1340	158	....	"	Sept. 5	.28	.38	C.	Earthy, veg.
1402	185	....	"	Oct. 3	.18	.23	S.	Vegetative.
1482	217	....	"	Nov. 3	.20	.08	V. S.	None.
AVERAGE ....				.....	.21	.21	.....	.....

1058	17	112	Urbana, below town	April 19	.35	.25	C.	Strong.
1121	42	....	"	May 24	.58	.19	C.	Strawboard.
1183	70	....	"	June 20	.60	.35	C.	"
1213	87	....	"	July 9	.22	.30	C.	Vegetative.
1277	129	....	"	Aug. 9	.52	.20	C.	Foul.
1339	157	....	"	Sept. 5	.55	.42	C.	Strawboard.
1403	186	....	"	Oct. 3	.55	.27	C.	"
1483	218	....	"	Nov. 3	.40	.25	M.	"
AVERAGE ....				.....	.47	.28	.....	.....

1041	2	100	Springfield, above town	April 16	.20	.07	S.	Earthy.
1123	44	....	"	May 24	.27	.12	C.	Vegetative.
1188	73	....	"	June 20	.25	.20	C.	Earthy.
1223	97	....	"	July 10	.22	.30	S.	Sweet, veget.
1279	131	....	"	Aug. 9	.35	.19	C.	Vegetative.
1341	159	....	"	Sept. 5	.23	.36	C.	"
1405	188	....	"	Oct. 3	.29	.27	C.	"
1481	215	....	"	Nov. 3	.38	.15	C.	"
AVERAGE ....				.....	.27	.21	.....	.....

† Floating vegetation which had settled to bottom.

GREAT AND LITTLE MIAMI RIVERS AND TRIBUTARIES — Continued.

b MAD RIVER BASIN.

Million.)

Buck Creek.

Oxygen required.	Nitrogen as				Chlorine.	Alkalinity.	Incrusting constituents.	Total solids.	Loss on ignition.	Dissolved oxygen.	Bacteria per c. c.	Temperature °C.
	Albuminoid ammonia.	Free ammonia.	Nitrites.	Nitrates.								
1.67	.104	.016	.005	.84	.4	242.0	2.98	407	124	9.83	325	13.0
2.48	.328	.032	.010	1.14	.3	244.4	27.2	431	135	9.70	1200	20.5
2.26	.096	.036	.008	.83	.2	268.0	12.0	438	135	9.10	375	25.0
4.01	.176	.028	.010	1.06	.4	260.2	30.0	463	145	7.79	800	25.0
2.63	.134	.042	.010	1.64	T	227.6	29.0	384	115	9.35	400	30.5
2.77	.206	.044	.011	1.46	T	239.4	1.8	386	123	9.68	600	27.0
1.99	.112	.022	.002	1.63	.4	219.4	3.0	425	150	9.90	1200	24.0
1.65	.078	.019	.014	2.12	.5	249.4	13.2	399	82	10.30	1000	8.5
2.43	.154	.030	.009	1.34	.3	243.8	18.2	417	126	9.46	738	.....

Mad River.

6.90	.258	.014	.010	1.87	T	229.0	60.6	497	167	9.67	12000	13.0
9.82	.104	.040	.010	.82	.5	265.4	3.0	347	92	7.92	700	17.5
3.52	.170	.050	.009	.83	T	271.8	26.8	434	131	8.73	1700	19.5
4.22	.220	.060	.017	.64	.2	266.2	11.4	410	76	9.00	2200	20.5
3.95	.182	.054	.016	1.04	.2	250.4	None	396	103	7.60	3300	24.5
5.53	.380	.032	.007	.83	T	230.4	21.0	438	127	8.86	5900	20.5
3.24	.130	.032	.006	1.26	1.0	260.2	1.6	462	173	8.70	4000	18.0
2.53	.086	.019	.005	T	T	251.4	1.4	390	112	11.05	2200	10.5
4.96	.191	.038	.010	.91	.2	253.1	14.5	422	123	8.94	4000	.....
14.50	.400	.026	.024	2.80	.4	225.0	43.4	466	156	9.40	39500	14.5
66.96	.602	.028	.144	T	.7	285.2	24.0	396	147	6.60	63600	17.5
25.46	.540	.014	.044	None	.2	305.6	36.2	485	163	5.86	109000	18.0
7.85	.360	.052	.028	.62	.6	282.8	17.0	399	105	6.50	6800	19.5
61.64	.564	.024	.076	T	6.4	284.6	11.6	463	155	6.03	17500	24.0
27.98	.910	.028	.112	.16	.3	266.6	None	481	167	5.85	111000	20.0
21.00	.780	.060	.010	.06	.6	283.8	None	493	180	6.10	803000	18.0
28.96	.712	.080	.044	.13	.5	295.8	None	462	149	6.70	135600	11.0
31.79	.608	.039	.060	.47	1.2	278.7	16.5	456	153	6.63	160750	.....
3.26	.120	.030	.016	1.06	.5	261.0	11.8	412	142	9.60	3300	12.0
8.34	.268	.022	.062	.08	.2	276.2	5.6	426	126	7.74	30000	19.0
3.98	.187	.176	.018	.44	.7	278.6	40.4	423	129	7.98	7400	23.5
5.40	.226	.132	.026	1.04	.9	268.2	None	462	153	7.50	3200	24.0
7.15	.334	.048	.007	None	.4	288.2	None	430	134	8.00	1400	28.0
4.68	.366	.136	.032	1.11	.8	248.4	39.0	430	143	8.43	2700	23.5
7.56	.276	.036	.018	.08	.2	274.8	None	456	167	7.57	7800	20.0
11.49	.306	.024	.048	.04	.5	281.4	None	410	134	9.05	20800	10.0
6.48	.260	.076	.028	.48	.5	272.1	12.1	431	141	8.23	9575	.....

RECORD OF CHEMICAL AND BACTERIOLOGICAL EXAMINATIONS OF

Mad River — Concluded.

(Parts per

Sample number.	Serial number.	Approximate distances.	Locality of sample.	Date collected.	Color.	Turbidity.	Sediment.	Odor.
1042	3	99	Springfield, below town	April 16	.20	.07	S.	Faint musty.
1122	43	....	"	May 24	.27	.13	C.	Musty.
1189	74	....	"	June 20	.25	.24	C.	Faint musty.
1224	98	....	"	July 10	.20	.24	C.	"
1278	130	....	"	Aug. 9	.28	.17	C.	Musty.
1342	160	....	"	Sept. 5	.21	.32	S.	Vegetative.
1404	187	....	"	Oct. 3	.21	.21	C.	Faint musty.
1480	214	....	"	Nov. 3	.32	.13	C.	"
AVERAGE ....				.....	.24	.19	.....	.....
1059	11	80	Dayton, above town	April 18	.20	.28	C.	Earthy.
1117	36	....	"	May 23	.12	.13	S.	"
1175	65	....	"	June 19	.22	.27	C.	Faint earthy.
1219	93	....	"	July 10	.20	.14	V. S.	Faint sour.
1270	123	....	"	Aug. 8	.20	.23	S.	Earthy.
1333	151	....	"	Sept. 4	.23	.23	C.	Vegetative.
1396	180	....	"	Oct. 2	.23	.19	S.	Earthy.
1473	209	....	"	Nov. 2	.19	.16	S.	"
AVERAGE ....				.....	.20	.20	.....	.....

C GREAT MIAMI BASIN.

Great Miami River.

1046	7	124	Sidney, above town	April 17	.20	.11	S.	Vegetative.
1111	32	....	"	May 22	.20	.16	S.	"
1179	61	....	"	June 18	.22	.15	S.	"
1216	90	....	"	July 9	.22	.20	S.	"
1266	119	....	"	Aug. 7	.30	.12	S.	"
1330	148	....	"	Sept. 3	.26	.22	S.	"
1392	174	....	"	Oct. 1	.24	.14	S.	Faint veg've.
1471	205	....	"	Nov. 1	.22	.22	S.	Vegetative.
AVERAGE ....				.....	.23	.16	.....	.....
1045	6	122	Sidney, below town	April 17	.20	.11	S.	Vegetative.
1110	31	....	"	May 22	.22	.09*	S.	"
1178	60	....	"	June 18	.28	.10*	S.	"
1215	89	....	"	July 9	.20	.14	S.	"
1265	118	....	"	Aug. 7	.30	.09*	S.	"
1329	147	....	"	Sept. 3	.27	.15	S.	"
1391	173	....	"	Oct. 1	.25	.17	S.	"
1470	204	....	"	Nov. 1	.20	.13	S.	"
AVERAGE ....				.....	.24	.12	.....	.....

GREAT AND LITTLE MIAMI RIVERS AND TRIBUTARIES — Continued.

Million.)

Mad River — Concluded.

Oxygen required.	Nitrogen as						Incrusting constituents.	Total solids.	Loss on ignition.	Dissolved oxygen.	Bacteria per c. c.	Temperature °C.
	Albuminoid ammonia.	Free ammonia.	Nitrites.	Nitrates.	Chlorine.	Alkalinity.						
2.69	.170	.144	.032	1.52	1.7	256.2	22.2	427	126	9.30	7600	12.0
14.08	.276	.262	.084	.26	2.4	274.8	25.2	404	128	7.25	43800	19.0
4.19	.226	.152	.036	.58	3.6	279.6	3.2	484	159	7.70	18300	24.0
4.52	.210	.202	.044	.85	3.5	267.2	13.8	459	153	7.38	10000	25.0
5.37	.320	.302	.028	.27	4.5	273.4	None	405	130	8.01	5900	28.0
4.05	.296	.172	.038	1.28	4.5	260.0	9.4	427	151	8.72	115100	24.0
5.41	.346	.110	.022	.04	3.1	272.2	None	473	164	7.22	29700	20.5
7.25	.314	.266	.052	.04	3.3	281.4	None	401	141	8.07	14600	10.0
5.94	.270	.201	.042	.60	3.3	270.6	9.2	435	144	7.96	30625	.....
5.19	.272	.076	.030	2.05	1.5	241.6	12.8	535	150	9.00	30900	14.0
3.08	.148	.034	.016	.78	3.0	259.8	32.2	368	99	8.77	1500	19.0
3.85	.163	.016	.012	.39	3.1	266.0	37.0	460	183	8.55	2700	21.0
3.34	.202	.018	.005	.60	4.0	259.2	None	408	53	9.32	3300	24.0
3.41	.156	.039	.007	.67	2.5	243.2	None	425	161	9.00	1700	26.5
4.34	.227	.033	.008	.91	2.6	257.8	None	451	123	8.96	5800	13.5
4.77	.217	.029	.002	.77	2.9	250.2	None	406	125	8.95	5600	19.5
2.97	.170	.020	.012	4.42	2.7	261.0	2.98	385	111	9.03	2500	13.0
3.87	.194	.033	.011	1.32	2.8	254.8	14.0	417	126	8.95	6750	.....

C GREAT MIAMI BASIN.

Great Miami River.

4.77	.194	.024	.010	3.59	.4	194.2	52.8	408	147	8.99	1700	11.0
4.20	.326	.070	.010	.35	1.7	230.2	33.0	381	124	10.70	450	23.5
4.80	.226	.104	.010	None	.4	237.0	35.0	414	109	10.90	800	27.0
8.11	.330	.048	.010	.19	1.6	221.2	68.4	457	125	9.63	1000	27.0
5.57	.270	.074	.008	None	.4	212.2	1.0	350	130	11.72	650	31.0
6.04	.360	.100	.022	.03	.2	220.4	56.0	406	117	8.60	750	27.0
5.11	.258	.048	.003	None	.4	221.0	None	393	129	8.82	6600	21.0
6.28	.398	.057	.002	T	.6	222.0	20.4	422	117	9.97	3300	17.0
5.61	.295	.066	.009	.52	.7	219.8	33.3	404	125	9.92	1906	.....
4.65	.246	.038	.016	3.02	.6	205.8	42.0	430	156	10.03	6100	11.0
3.88	.388	.080	.018	.58	2.6	226.8	13.0	345	120	12.00	1600	24.0
4.23	.226	.112	.016	.08	3.8	252.6	54.0	402	135	9.23	1600	26.5
6.19	.256	.052	.014	.56	2.7	231.2	30.4	360	81	9.30	2700	27.0
5.77	.254	.098	.018	None	3.4	219.8	5.4	352	128	10.70	2900	31.0
5.87	.364	.094	.016	.32	1.9	223.6	25.8	374	131	10.92	5700	27.0
5.77	.316	.056	.004	None	.9	199.0	None	364	120	9.53	6600	20.5
6.25	.315	.063	.008	T	2.5	232.6	36.8	409	121	10.94	10800	17.0
5.33	.289	.074	.014	.57	2.3	223.9	25.9	379	124	10.33	4750	.....

RECORD OF CHEMICAL AND BACTERIOLOGICAL EXAMINATIONS OF

Great Miami River — Continued.

(Parts per

Sample number.	Serial number.	Approximate dis- tances.	Locality of sample.	Date collected.	Color.	Turbidity.	Sediment.	Odor.
1049	14	111	Piqua, above town.	April 18	.35*	3.00	M.	Earthy.
1108	29	....	" "	May 22	.30	.17	C.	Vegetative.
1172	58	....	" "	June 18	.25	.33	C.	Earthy.
1228	103	....	" "	July 11	.27	.15	S.	Vegetative.
1263	116	....	" "	Aug. 7	.25	.12	S.	Faint musty.
1325	145	....	" "	Sept. 3	.25	.18	S.	Vegetative.
1389	175	....	" "	Oct. 1	.30	.40	C.	"
1466	202	....	" "	Nov. 1	.28	.26	S.	Earthy.
AVERAGE ....				.....	.28	.58	.....	.....
1050	15	108	Piqua, below town.	April 18	.22	2.70	M.	Earthy.
1109	30	....	" "	May 22	.30	.11*	S.	Faint musty.
1173	59	....	" "	June 18	.27	.26	C.	Faint musty and earthy.
1227	102	....	" "	July 11	.28	.14	S.	Sour.
1264	117	....	" "	Aug. 7	.28	.17*	S.	Musty.
1326	146	....	" "	Sept. 3	.26	.15*	S.	Vegetive and faint musty.
1390	176	....	" "	Oct. 1	.30	.30	C.	Musty.
1467	203	....	" "	Nov. 1	.24	.24	S.	Faint musty.
AVERAGE ....				.....	.27	.51	.....	.....
1043	4	103	Troy, above town.	April 17	.20	.12	S.	Faint sour.
1115	40	....	" "	May 23	.20	.08	S.	Faint musty.
1186	69	....	" "	June 19	.27	.13	S.	"
1230	101	....	" "	July 11	.30	.18	S.	Musty.
1274	127	....	" "	Aug. 8	.34	.10	S.	Faint musty.
1338	156	....	" "	Sept. 4	.28	.15	S.	"
1401	184	....	" "	Oct. 2	.27	.15	S.	"
1477	213	....	" "	Nov. 2	.25	.21	S.	"
AVERAGE ....				.....	.26	.14	.....	.....
1044	5	100	Troy, below town.	April 17	.18	.14	S.	Faint sour.
1114	39	....	" "	May 23	.16	.08*	S.	" musty.
1185	68	....	" "	June 19	.27	.06	S.	Musty.
1229	100	....	" "	July 11	.28	.12	S.	Faint musty.
1273	126	....	" "	Aug. 8	.20	.06	S.	"
1337	155	....	" "	Sept. 4	.29	.11	S.	"
1400	183	....	" "	Oct. 2	.25	.08	V. S.	"
1476	212	....	" "	Nov. 2	.26	.13	S.	"
AVERAGE ....				.....	.24	.10	.....	.....

GREAT AND LITTLE MIAMI RIVERS AND TRIBUTARIES — Continued.

Million.)

Great Miami River — Continued.

Oxygen required.	Nitrogen as				Chlorine.	Alkalinity.	Incrusting constituents.	Total solids.	Loss on ignition.	Dissolved oxygen.	Bacteria per c. c.	Temperature °C.
	Albuminoid ammonia.	Free ammonia.	Nitrites.	Nitrates.								
25.87	1.012	.062	.008	4.40	T	118.6	38.8	1123	189	9.40	57000	15.0
4.26	.348	.094	.016	.33	1.9	225.8	41.8	367	129	9.08	1400	20.0
5.18	.266	.066	.018	.18	.8	239.0	50.0	463	152	7.29	3700	23.0
6.18	.332	.056	.006	T	1.4	219.2	32.4	426	159	9.83	2900	26.0
5.32	.256	.086	.012	None	1.6	205.2	15.2	370	136	6.85	4400	27.0
5.42	.330	.110	.012	.27	.6	206.4	29.0	355	114	5.60	4100	25.5
5.96	.272	.058	.003	None	.7	170.2	8.8	353	116	8.40	7100	21.0
6.42	.386	.086	.004	T	2.2	220.2	39.0	414	116	8.30	8000	17.0
8.08	.400	.077	.010	.65	1.2	200.6	31.9	484	139	8.09	11075	.....
17.02	.794	.044	.009	4.95	T	137.4	19.0	853	156	9.15	61700	15.0
4.44	.356	.114	.032	.74	4.1	228.2	31.8	364	130	9.56	9000	21.0
5.35	.294	.116	.022	.32	1.6	241.0	36.0	493	189	8.05	12100	24.5
6.24	.340	.062	.034	.49	4.8	226.2	47.4	499	184	8.23	14300	26.0
5.44	.210	.086	.040	None	5.1	223.8	22.0	384	144	7.69	14800	28.0
5.81	.292	.130	.032	.67	4.8	216.0	15.8	387	127	7.41	8900	25.0
6.72	.300	.042	.012	T	2.5	178.2	3.2	371	134	8.06	21300	21.5
6.36	.408	.077	.032	None	4.0	220.4	25.0	394	126	8.26	39000	17.0
7.17	.374	.084	.027	.90	3.4	208.9	25.0	468	149	8.30	22638	.....
4.39	.260	.348	.032	2.62	1.9	187.0	53.8	407	161	8.03	10600	11.0
5.97	.402	.098	.016	.22	2.6	228.0	17.0	352	92	9.06	3000	23.0
5.34	.275	.080	.016	.47	1.6	237.2	55.0	423	144	8.99	6300	25.0
6.66	.368	.044	.022	.45	2.5	222.4	47.4	465	174	6.38	5100	24.0
6.75	.288	.106	.008	T	2.3	215.8	4.2	337	106	8.90	5900	30.0
6.54	.488	.102	.026	.54	2.5	207.4	10.2	377	131	7.05	2800	26.5
6.59	.332	.034	.010	.03	2.3	195.4	22.8	353	139	6.69	6500	21.5
6.99	.336	.029	.018	T	3.4	224.4	7.4	389	122	7.55	4800	15.0
6.15	.344	.105	.018	.54	2.4	214.7	27.2	388	134	7.83	5625	.....
4.33	.222	.064	.024	3.42	1.4	184.8	56.6	379	127	7.82	6400	11.0
4.85	.418	.212	.022	.45	5.0	240.4	40.0	347	95	10.26	4800	23.0
5.69	.282	.180	.030	.11	2.6	247.8	17.6	383	120	10.00	109500	25.0
5.81	.372	.076	.028	.37	3.7	231.2	13.0	438	170	7.25	8600	24.0
4.83	.276	.120	.010	.22	3.0	224.8	None	312	107	10.41	4000	29.5
5.88	.534	.126	.018	.34	2.8	213.2	29.2	342	130	9.87	5600	26.5
5.88	.338	.084	.014	T	3.4	210.4	None	338	130	8.50	45600	21.5
7.41	.586	.038	.003	T	3.4	222.6	7.0	377	115	6.05	228000	15.0
5.58	.378	.112	.019	.61	3.2	221.9	20.4	364	124	8.77	51562	.....

RECORD OF CHEMICAL AND BACTERIOLOGICAL EXAMINATIONS OF

Great Miami River — Continued.

(Parts per

Sample number.	Serial number.	Approximate distances.	Locality of sample.	Date collected.	Color.	Turbidity.	Sediment.	Odor.
1053	12	80	Dayton, above town	April 18	.25	.21	C.	Earthy.
1118	37	....	" "	May 23	.22	.19	S.	Faint musty.
1176	66	....	" "	June 19	.30	.30	C.	Vegetative.
1220	94	....	" "	July 10	.25	.19	S.	Veg., earthy.
1271	124	....	" "	Aug. 8	.26	.20	S.	Earthy.
1334	152	....	" "	Sept. 4	.30	.33	C.	Vegetative.
1397	181	....	" "	Oct. 2	.21	.26	C.	Faint musty.
1474	210	....	" "	Nov. 2	.19	.29	S.	Earthy.
AVERAGE ....				.....	.25	.25	.....	.....
1052	10	75	Dayton, below town	April 18	.28	.60	C.	Faint musty.
1116	35	....	" "	May 23	.26	.13	C.	"
1174	64	....	" "	June 19	.23	.11	C.	Earthy.
1222	96	....	" "	July 10	.25	.15	S.	Musty.
1269	122	....	" "	Aug. 8	.24	.16	S.	"
1336	154	....	" "	Sept. 4	.26	.20	S.	Musty, oily.
1395	179	....	" "	Oct. 2	.25	.16	S.	Musty.
1472	208	....	" "	Nov. 2	.22	.18	S.	Faint musty.
AVERAGE ....				.....	.25	.21	.....	.....
1075	26	49	Middletown, above town	April 26	.22	.09	C.	Strong veg.
1129	49	....	"	May 28	.31	.14	S.	Vegetative.
1205	83	....	"	June 28	.35	1.90	M.	"
1242	108	....	"	July 19	.26	.57	C.	Faint musty.
1306	141	....	"	Aug. 22	.26	.67	C.	Earthy, veg.
1366	172	....	"	Sept. 19	.18	.13	V. S.	Vegetative.
1429	190	....	"	Oct. 13	.38	.35	C.	"
1486	220	....	"	Nov. 7	.23	.12	S.	"
AVERAGE ....				.....	.27	.50	.....	.....
1074	25	47	Middletown, below town	April 26	.24	.21	C.	Vegetative.
1130	50	....	"	May 28	.31	.16	S.	Faint musty.
1206	84	....	"	June 28	.35	1.80	M.	Oily.
1243	109	....	"	July 19	.26	.54	C.	Musty.
1307	142	....	"	Aug. 22	.30	.73	C.	Earthy.
1365	171	....	"	Sept. 19	.28	.30	S.	Veg., ft. must.
1430	191	....	"	Oct. 13	.33	.31	C.	Musty.
1487	221	....	"	Nov. 7	.25	.23	S.	"
AVERAGE ....				.....	.29	.53	.....	.....

GREAT AND LITTLE MIAMI RIVERS AND TRIBUTARIES — Continued.

(Million.)

Great Miami River — Continued.

Oxygen required.	Nitrogen as				Chlorine.	Alkalinity.	Incrusting constituents.	Total solids.	Loss on ignition.	Dissolved oxygen.	Bacteria per c. c.	Temperature °C.
	Albuminoid ammonia.	Free ammonia.	Nitrites.	Nitrates.								
5.92	.248	.022	.020	3.74	.6	189.2	10.2	448	159	8.83	17600	13.5
5.94	.384	.084	.018	1.02	1.4	239.6	44.2	366	123	7.35	2700	21.0
5.61	.282	.044	.024	.47	1.8	237.0	23.0	445	188	9.90	4800	23.6
6.02	.312	.034	.014	.20	1.8	224.4	70.8	442	117	7.35	4700	24.5
5.24	.276	.073	.006	None	1.2	219.4	30.6	368	132	6.78	2900	28.5
6.99	.400	.074	.008	T	1.0	222.0	None	388	119	7.22	3500	26.0
5.30	.252	.028	.004	.04	2.3	224.0	None	403	158	7.40	5600	20.0
6.16	.304	.034	.013	T	1.8	212.0	20.2	400	105	7.30	3000	15.5
5.90	.307	.049	.013	.68	1.5	220.9	24.9	407	138	7.52	5600	.....
7.82	.396	.032	.020	3.36	.8	193.4	67.2	591	156	9.00	118600	13.0
4.52	.412	.102	.034	1.10	3.9	240.2	8.2	351	95	6.96	9700	18.5
4.27	.230	.084	.016	.40	4.7	245.0	47.0	436	200	6.70	22300	21.0
6.14	.264	.056	.030	1.16	5.5	237.2	4.0	352	103	8.30	150000	27.0
5.57	.284	.062	.018	.34	4.4	230.2	None	400	160	5.83	41400	26.5
5.18	.356	.066	.024	.68	3.9	225.6	33.0	398	150	9.22	8100	28.0
5.87	.259	.056	.008	.04	3.8	223.8	15.0	349	128	7.05	100900	19.5
4.31	.274	.076	.020	8.80	6.9	227.0	14.0	380	123	7.70	72900	13.5
5.46	.309	.067	.021	1.99	4.2	227.8	23.5	407	139	7.59	65487	.....
4.08	.216	.022	.018	2.60	1.6	204.2	6.0	373	152	10.07	4900	16.0
6.29	.224	.032	.032	.57	4.4	237.0	None	406	131	8.95	14100	21.5
10.11	.432	.084	.010	.12	.6	194.8	12.4	556	131	6.68	54900	26.0
9.32	.274	.054	.020	.32	4.0	211.0	54.6	453	140	7.16	21600	27.0
7.72	.278	.070	.013	T	2.4	204.8	40.8	403	144	6.39	40000	26.0
6.92	.232	.016	.008	T	6.1	230.2	18.0	422	102	9.82	9200	21.0
8.34	.253	.074	.014	None	3.3	189.0	None	410	134	8.45	2400	15.0
5.21	.176	.012	.008	.05	4.1	226.4	16.0	363	109	11.70	4000	12.5
7.25	.261	.045	.015	.46	3.3	212.2	18.5	423	130	8.65	18888	.....
4.70	.286	.034	.024	3.32	2.3	202.4	2.2	370	134	8.70	13000	16.0
7.91	.326	.058	.038	.49	4.5	232.4	20.0	460	151	7.16	27500	21.5
12.16	.464	.048	.012	.14	1.9	198.0	4.0	593	133	6.27	124100	25.5
11.11	.280	.074	.024	.08	7.3	222.0	39.8	484	173	5.90	36900	27.0
10.78	.332	.068	.015	T	4.2	240.8	17.8	446	153	5.67	97100	27.5
9.89	.438	.046	.020	None	9.3	239.8	None	463	131	8.09	33700	21.0
7.97	.273	.032	.016	T	5.1	186.8	27.6	434	156	7.45	2800	15.0
9.65	.318	.016	.026	.06	7.8	242.2	12.2	435	153	7.50	8800	13.5
9.27	.340	.047	.022	.51	5.3	220.5	15.4	461	148	7.09	42987	.....

RECORD OF CHEMICAL AND BACTERIOLOGICAL EXAMINATIONS OF

Great Miami River — Concluded.

(Parts per

Sample number.	Serial number.	Approximate distances.	Locality of sample.	Date collected.	Color.	Turbidity.	Sediment.	Odor.
1070	24	35	Hamilton, above town	April 25	.16	.09	C.	Vegetative.
1132	51	....	"	May 28	.28	5.60	M.	Earthy.
1207	81	....	"	June 27	.27	2.80	M.	Vegetative.
1240	110	....	"	July 19	.28	2.45	M.	Earthy.
1309	140	....	"	Aug. 21	.28	.93	C.	"
1372	170	....	"	Sept. 19	.25	.25	S.	Vegetative.
1427	192	....	"	Oct. 13	.43	.43	C.	Faint musty.
1488	222	....	"	Nov. 7	.25	.25	S.	"
AVERAGE ....				.....	.28	1.60	.....	.....
1069	23	32	Hamilton, below town	April 25	.18	.09	C.	Musty.
1133	52	....	"	May 28	.28	5.40	M.	Earthy.
1208	82	....	"	June 27	.27	1.80	M.	Oily.
1241	111	....	"	July 19	.26	1.40	M.	Earthy.
1308	139	....	"	Aug. 21	.28	.75	C.	"
1371	169	....	"	Sept. 19	.25	.23	S.	Faint musty.
1428	193	....	"	Oct. 13	.33	.44	C.	"
1489	223	....	"	Nov. 7	.27	.20	S.	Musty.
AVERAGE ....				.....	.26	1.29	.....	.....
1067	2	5	Cleves, below town	April 25	.16	.11	C.	Vegetative.
1135	53	....	"	May 29	.23	5.20	M.	Earthy and ft. musty.
1201	80	....	"	June 27	.30	2.00	M.	Earthy and ft. musty.
1247	115	....	"	July 20	.30	5.40	M.	Veg., earthy.
1298	138	....	"	Aug. 21	.28	.93	C.	Earthy.
1361	165	....	"	Sept. 18	.20	.34	S.	"
1431	194	....	"	Oct. 13	.31	.38	C.	Earthy, veg.
1497	227	....	"	Nov. 8	.27	.24	S.	Earthy.
AVERAGE ....				.....	.26	1.82	.....	.....

GREAT AND LITTLE MIAMI RIVERS AND TRIBUTARIES — Concluded.

(Million.)

Great Miami River — Concluded.

Oxygen required.	Nitrogen as				Chlorine.	Alkalinity.	Increasing constituents.	Total solids.	Loss on ignition.	Dissolved oxygen.	Bacteria per c. c.	Temperature °C.
	Albuminoid ammonia.	Free ammonia.	Nitrites.	Nitrates.								
3.04	.160	.030	.022	3.02	1.8	201.2	3.8	316	128	9.65	6100	18.5
26.89	.736	.076	.009	1.83	.1	122.4	7.4	1794	171	8.47	84500	19.5
12.78	.372	.082	.014	.98	1.1	186.4	None	621	115	7.02	53600	26.0
10.95	.374	.065	.012	.08	2.1	180.2	22.2	592	119	7.10	16700	28.0
7.24	.320	.096	.016	T	3.6	187.2	21.0	436	118	7.48	13600	29.0
7.01	.288	.031	.009	.07	7.1	226.0	8.2	416	106	9.68	1100	26.5
7.75	.268	.065	.008	T	3.6	179.4	29.2	418	134	8.56	2200	15.5
7.26	.246	.018	.007	T	5.5	227.2	19.6	417	125	9.78	25000	12.5
10.36	.345	.058	.012	.75	3.1	188.7	13.9	626	127	8.47	25350	.....
4.27	.254	.058	.030	2.60	3.3	206.8	15.8	347	137	9.02	8200	19.0
22.15	.788	.085	.012	1.36	2.1	140.4	2.8	1547	161	7.88	57600	19.5
9.32	.302	.072	.022	.34	3.9	230.0	35.6	467	122	6.78	78600	26.5
10.28	.342	.066	.016	.14	4.0	195.8	30.0	500	133	6.90	20400	28.0
7.69	.290	.078	.013	T	3.8	182.8	7.2	383	132	6.82	53800	29.0
7.50	.346	.122	.024	.06	9.7	230.6	12.6	414	111	7.70	3200	20.5
7.80	.263	.073	.010	T	4.4	181.2	None	371	122	8.40	7200	15.5
7.80	.304	.023	.018	.06	6.7	227.6	11.8	381	128	9.15	38200	12.0
9.60	.361	.072	.018	.57	4.7	199.4	14.5	551	131	7.83	33400	.....
4.27	.204	.032	.020	3.01	2.2	203.4	7.6	369	141	9.20	2400	18.5
19.43	.696	.100	.014	.77	.7	121.4	15.2	1721	188	7.93	7200	19.0
10.66	.510	.086	.012	.59	4.3	225.6	28.0	674	130	7.62	4400	27.0
22.82	.708	.082	.018	.08	2.2	165.0	28.8	2066	224	6.60	14500	27.0
7.26	.310	.061	.010	.04	3.6	172.2	.6	430	118	7.72	17200	30.0
5.50	.278	.029	.008	.12	7.2	232.4	11.4	450	98	9.32	2300	19.0
7.27	.282	.046	.006	3.3	4.6	187.4	None	412	121	9.40	2900	17.0
6.68	.258	.012	.008	.08	6.5	226.6	7.8	381	129	10.20	5400	9.0
10.49	.406	.056	.012	.63	3.9	191.7	12.4	813	144	8.50	7038	.....

VII. LIST OF PLATES.

In plotting the analytical findings of the Great Miami River it was found advisable to plot the main stream on one page and the two main tributaries on a second page. For convenience in plotting curve "B" (Mad River) the station above Dayton is placed 10 miles nearer Springfield than it should be, but the omission of that distance is indicated on the plates.

There are three series of plates including four sets of curves and a total of thirty-three plates as follows:

SERIES 1.

Curve "A" Little Miami River and East Fork of Little Miami River.

- Plate 1. Oxygen Required.
" 2. Nitrogen as Albuminoid Ammonia.
" 3. Nitrogen as Free Ammonia.
" 4. Nitrogen as Nitrites.
" 5. Nitrogen as Nitrates.
" 6. Chlorine.
" 7. Alkalinity.
" 8. Incrusting Constituents.
" 9. Total Solids.
" 10. Dissolved Oxygen.
" 11. Bacteria.

SERIES 2.

Curves "B" and "C".

Curve "B" Mad River and Buck Creek.

Curve "C" Stillwater River and Greenville Creek.

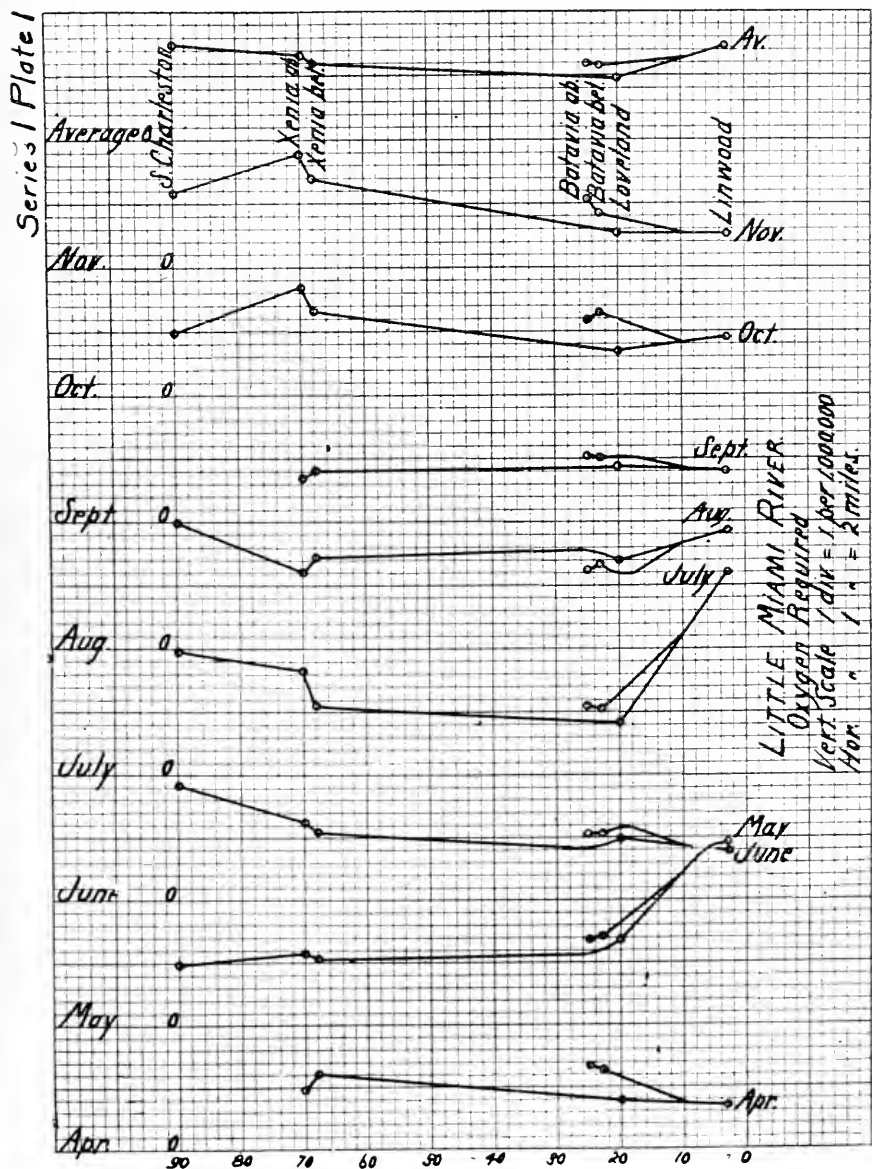
- Plate 12. Oxygen Required.
" 13. Nitrogen as Albuminoid Ammonia
" 14. Nitrogen as Free Ammonia.
" 15. Nitrogen as Nitrites.
" 16. Nitrogen as Nitrates.
" 17. Chlorine.
" 18. Alkalinity.
" 19. Incrusting Constituents.
" 20. Total Solids.
" 21. Dissolved Oxygen.
" 22. Bacteria.

SERIES 3.

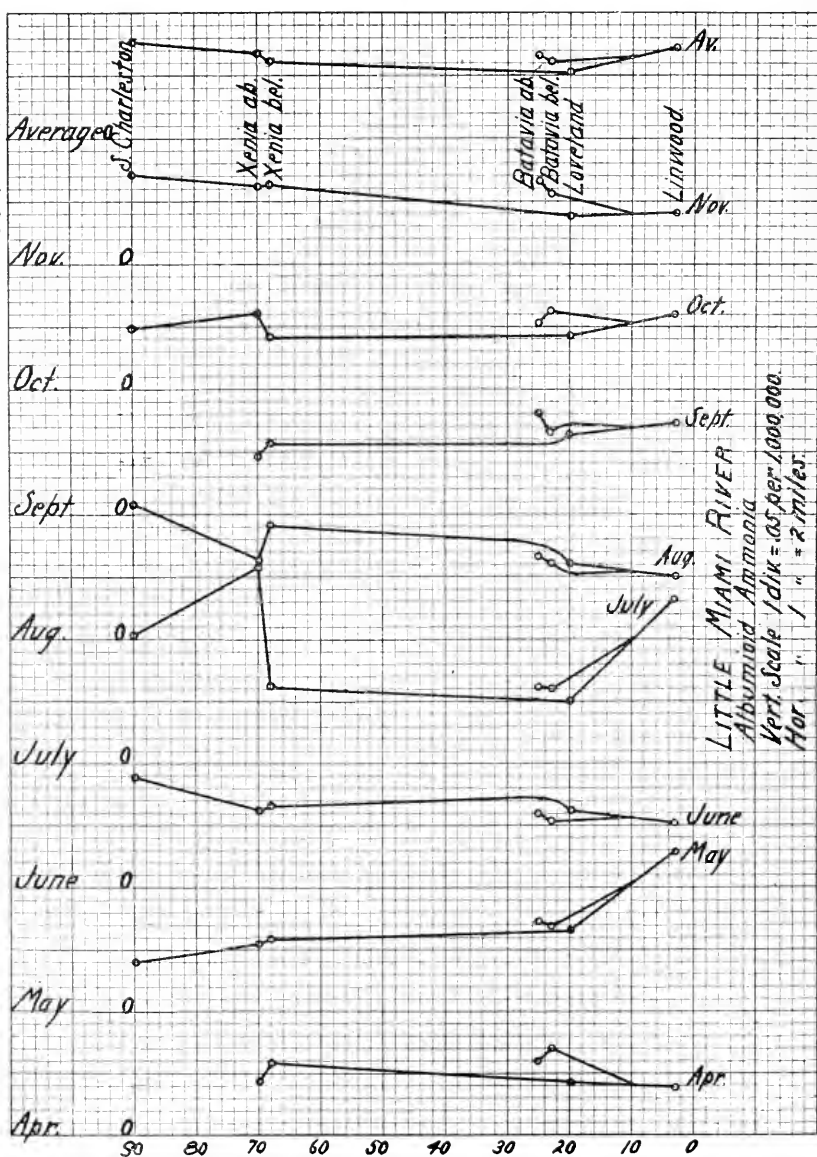
Curve "D" Great Miami River.

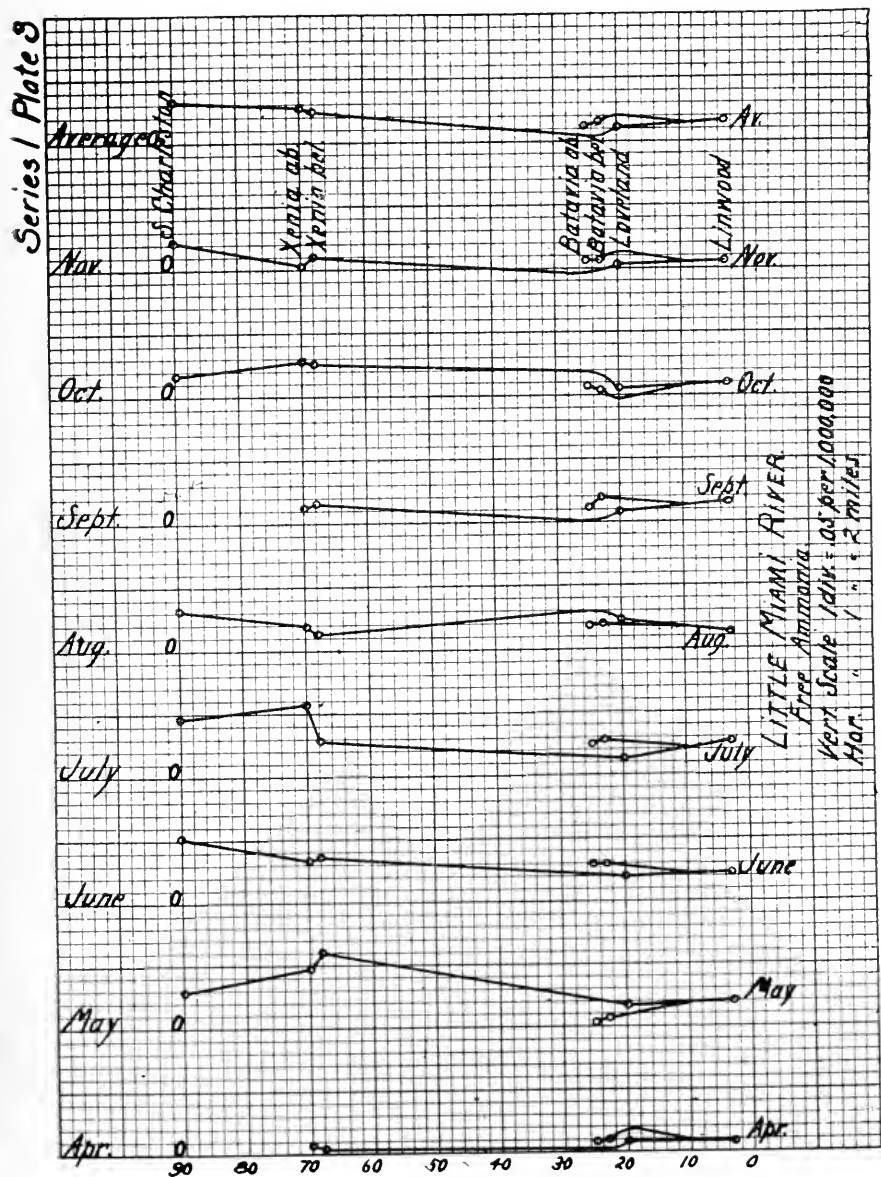
- Plate 23. Oxygen Required.
" 24. Nitrogen as Albuminoid Ammonia
" 25. Nitrogen as Free Ammonia.
" 26. Nitrogen as Nitrites.

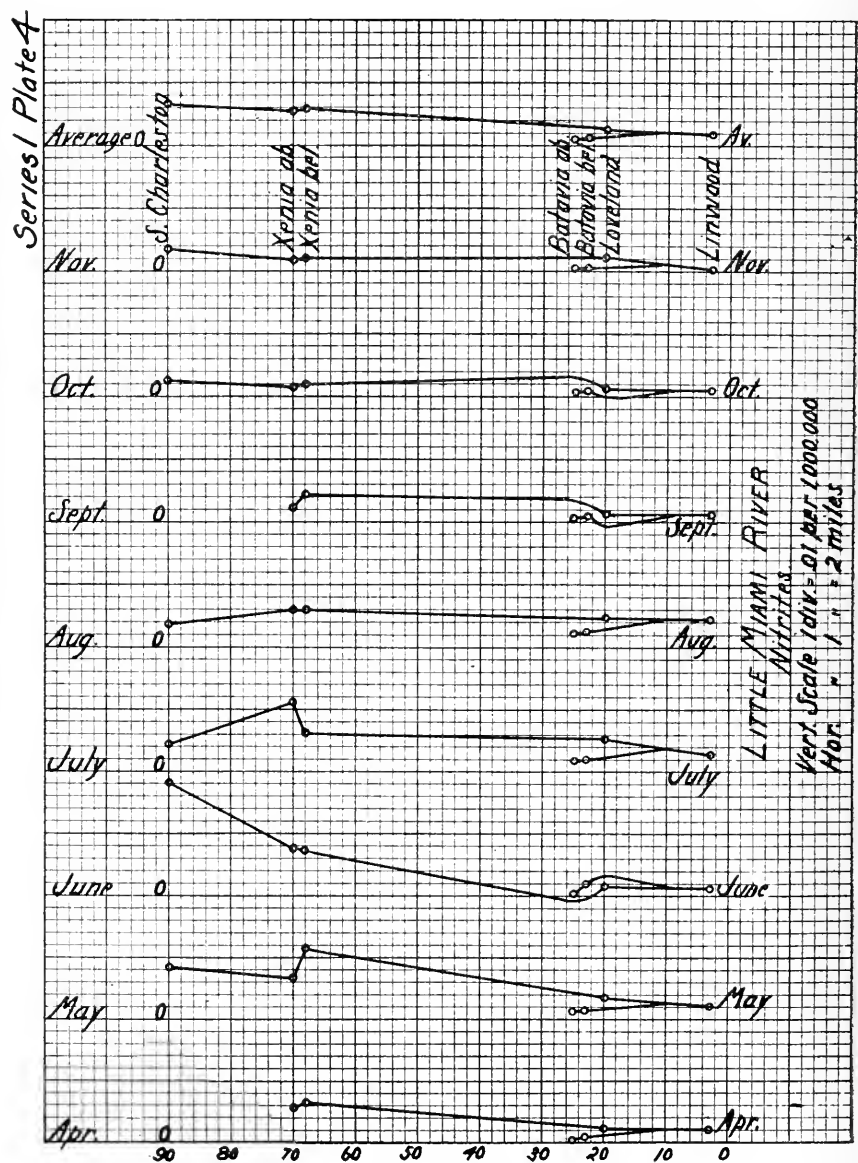
- Plate 27. Nitrogen as Nitrates.
 " 28. Chlorine.
 " 29. Alkalinity.
 " 30. Incrusting Constituents.
 " 31. Total Solids.
 " 32. Dissolved Oxygen.
 " 33. Bacteria.



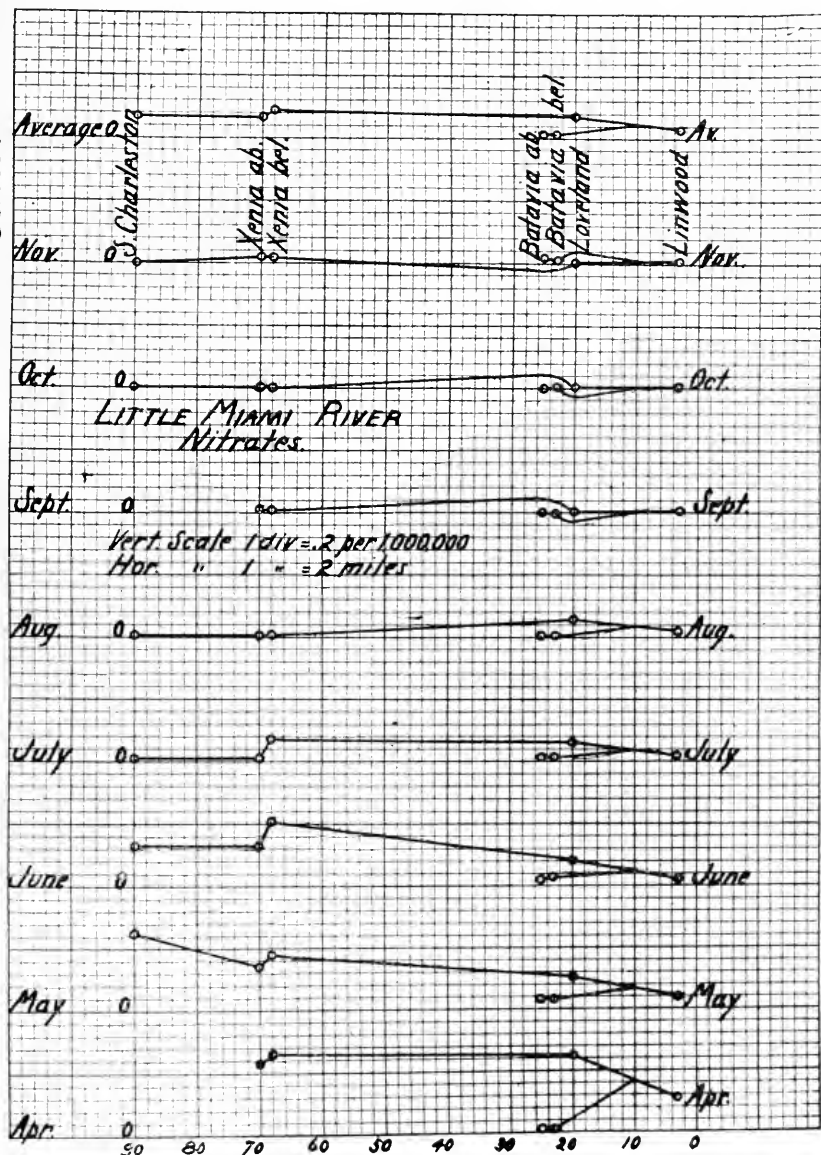
Series I Plate 2



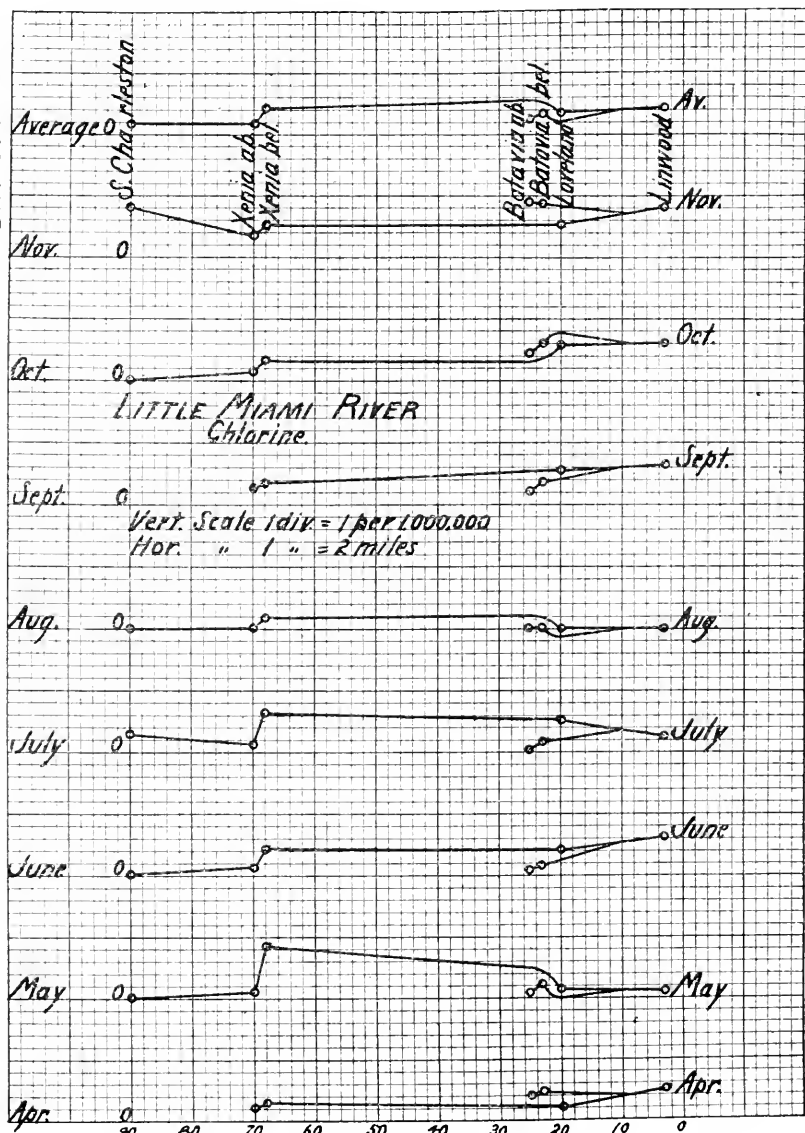


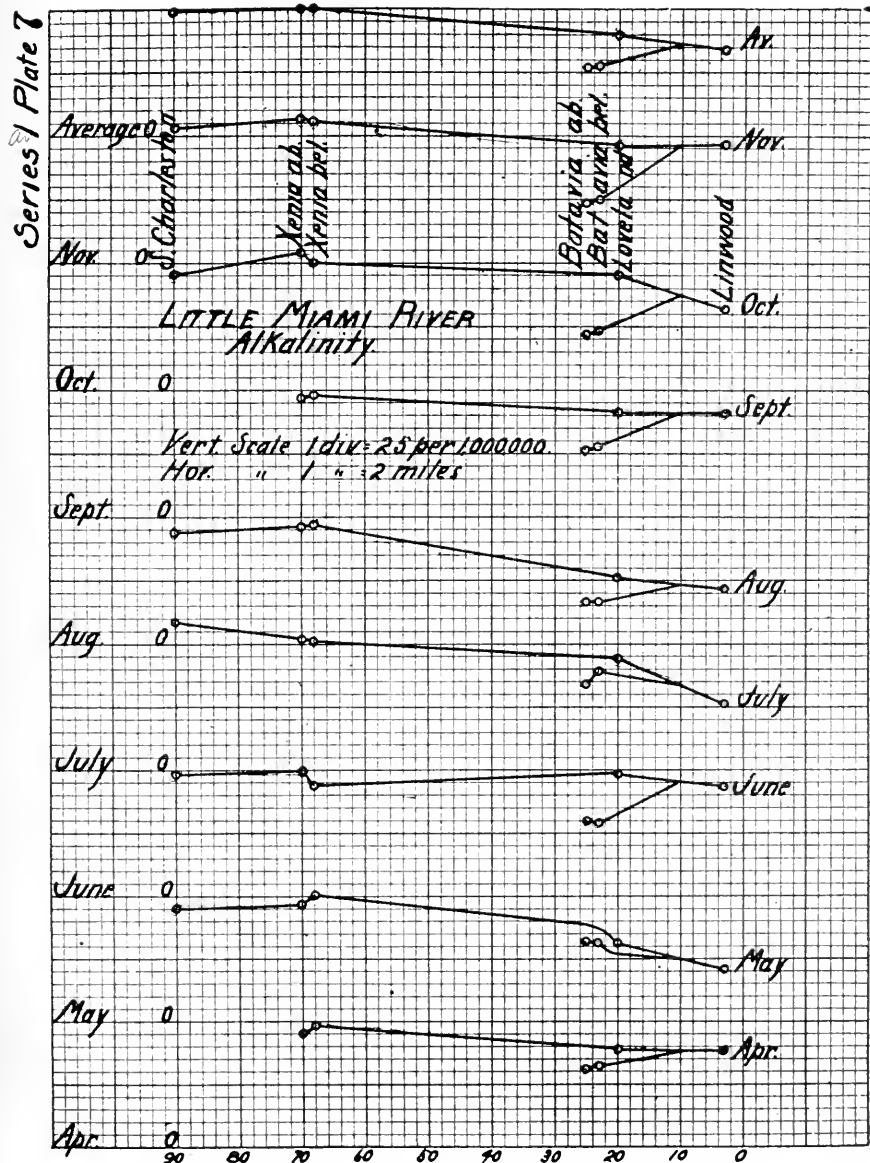


Series / Plate 5

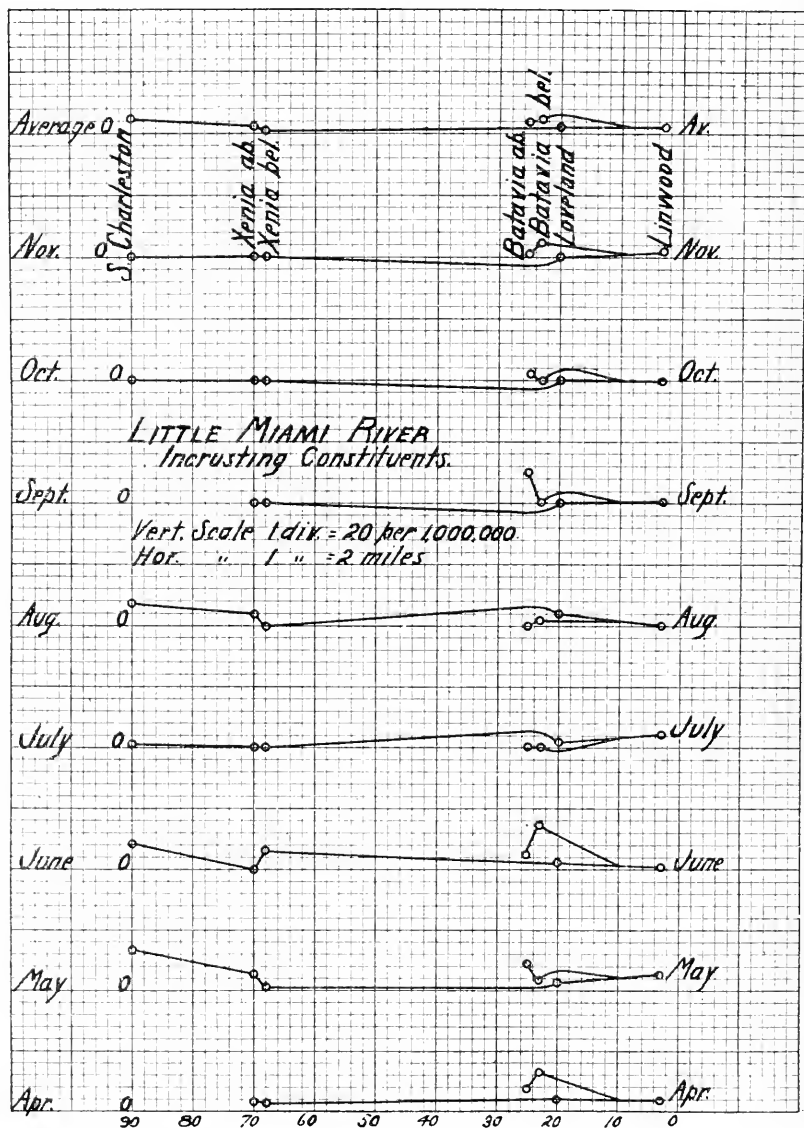


Series I Plate 6

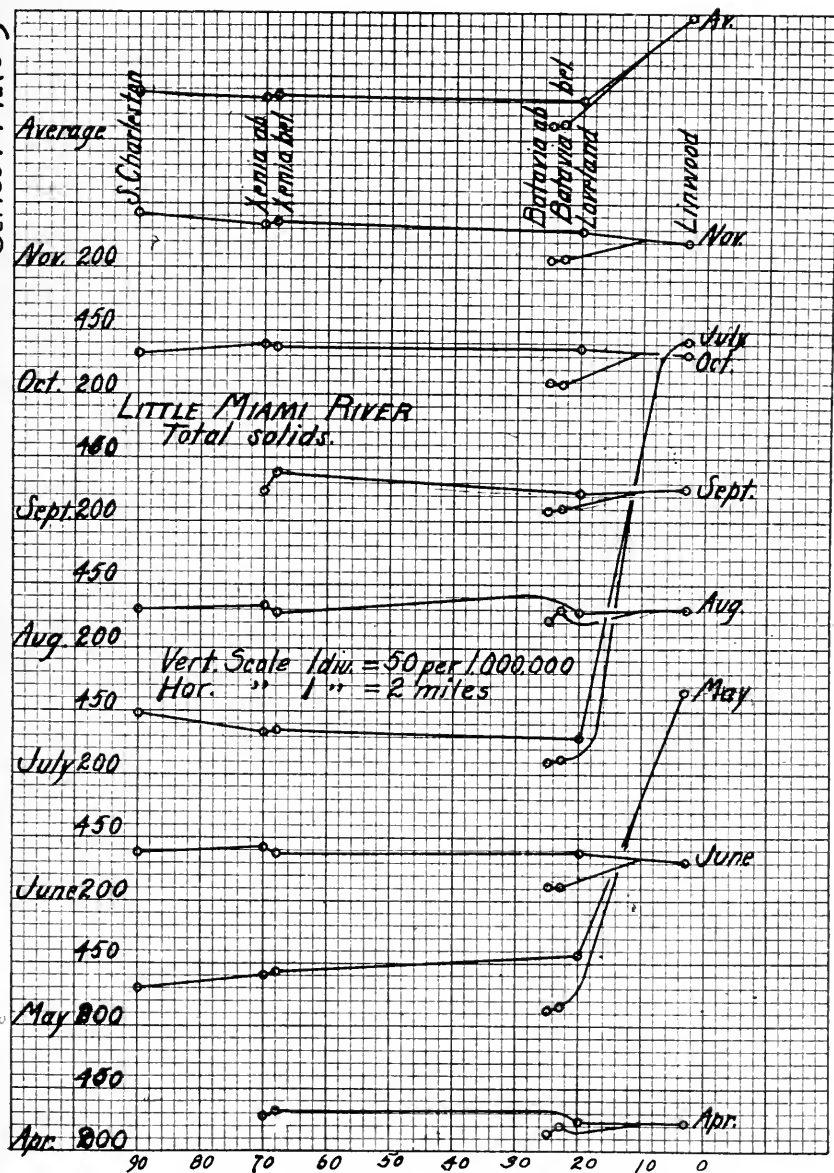


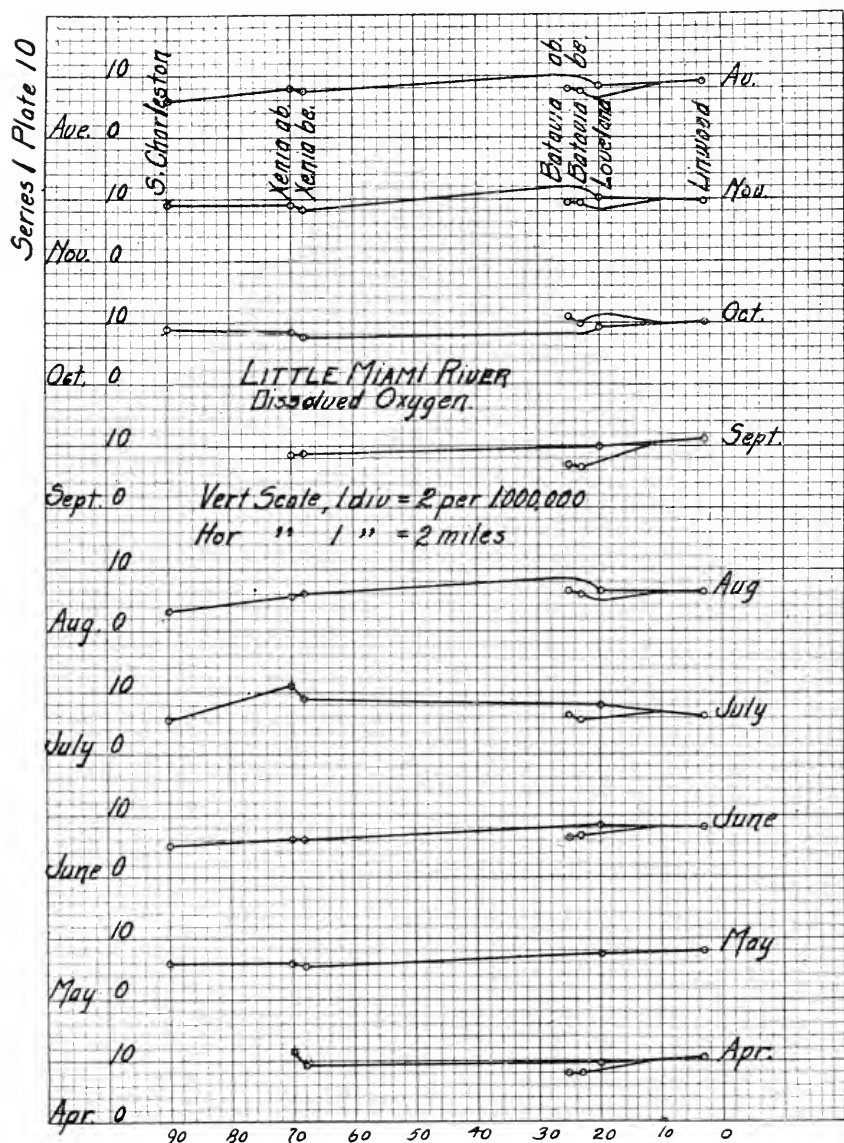


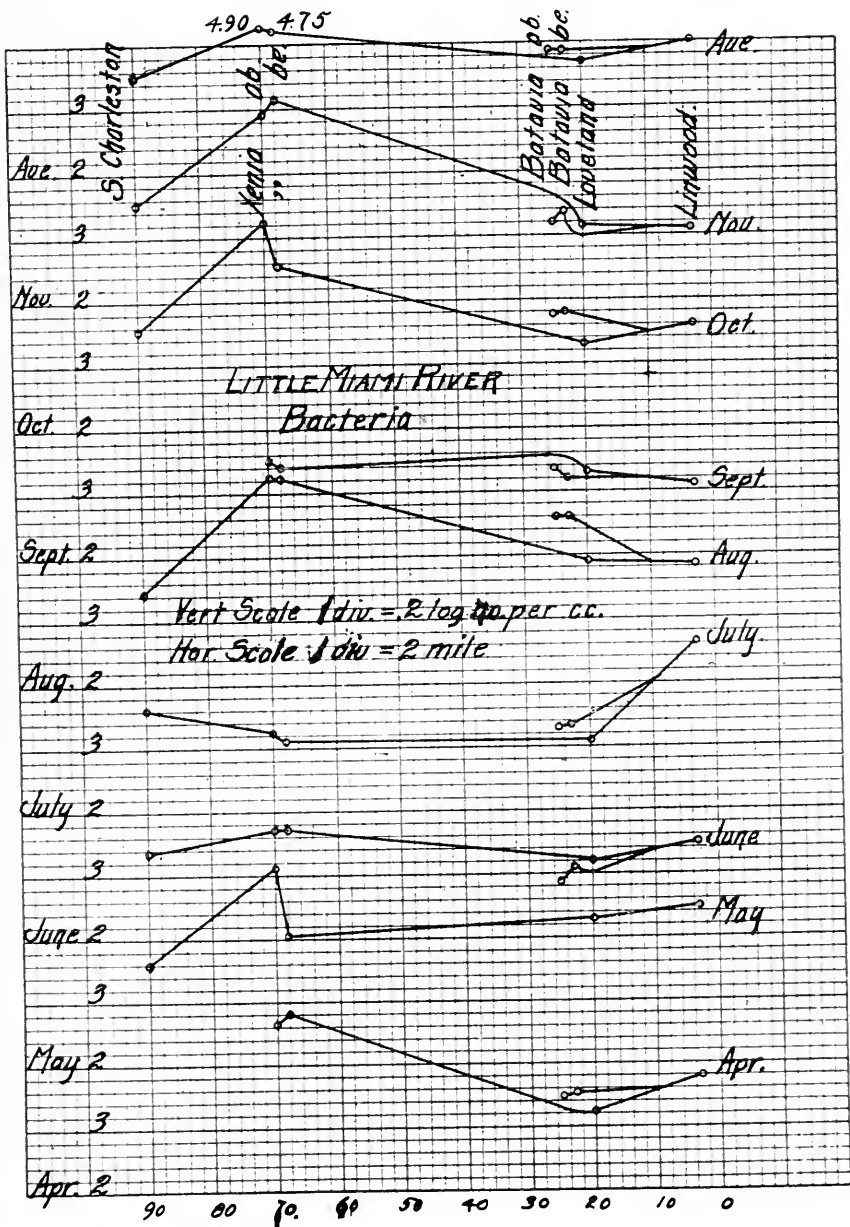
Series I Plate 8



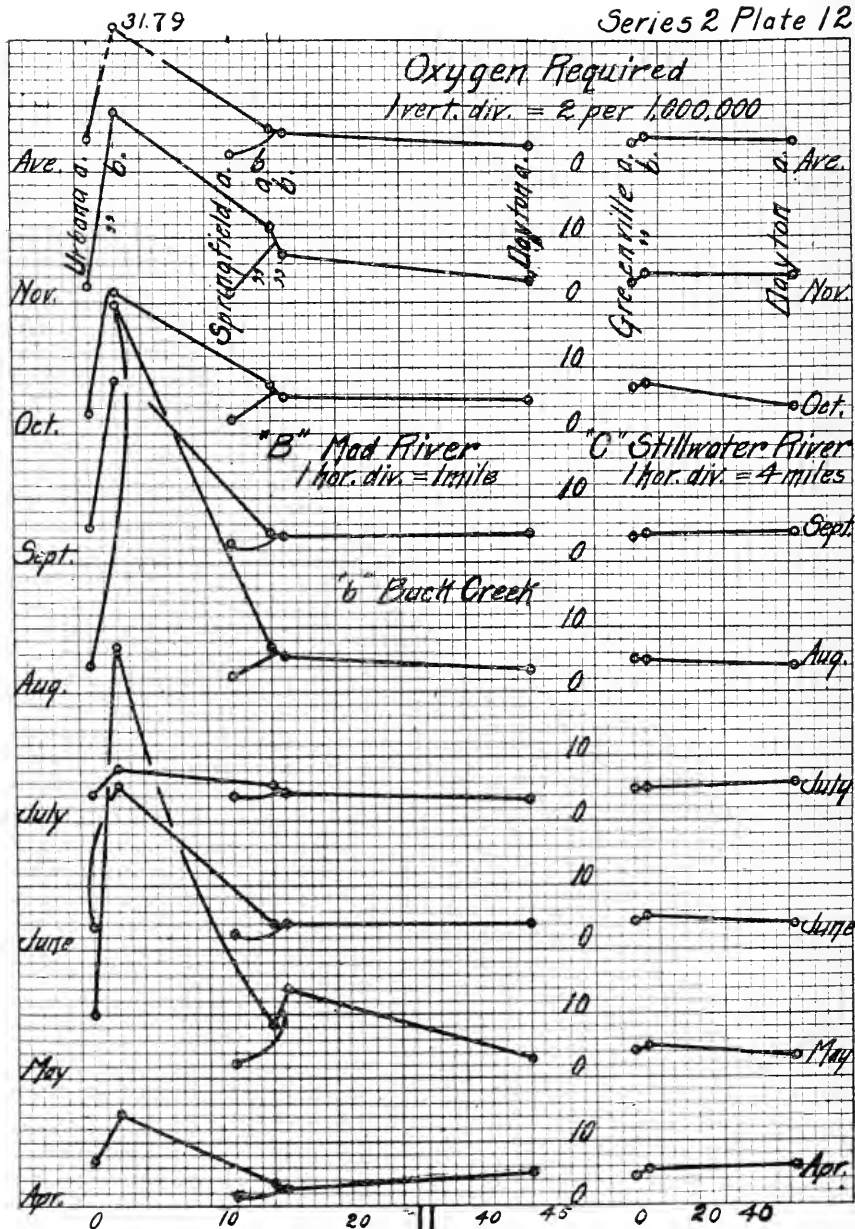
Series / Plate 9



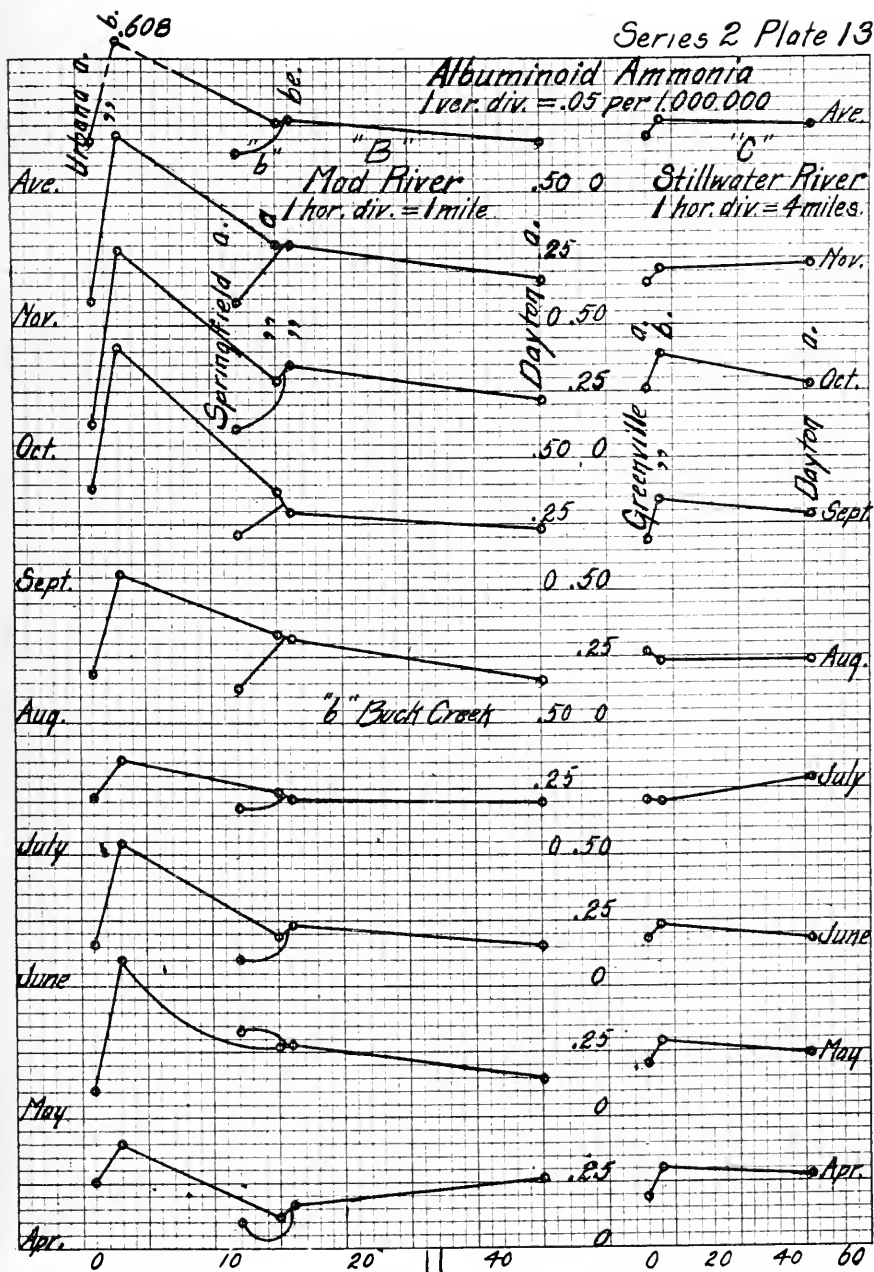




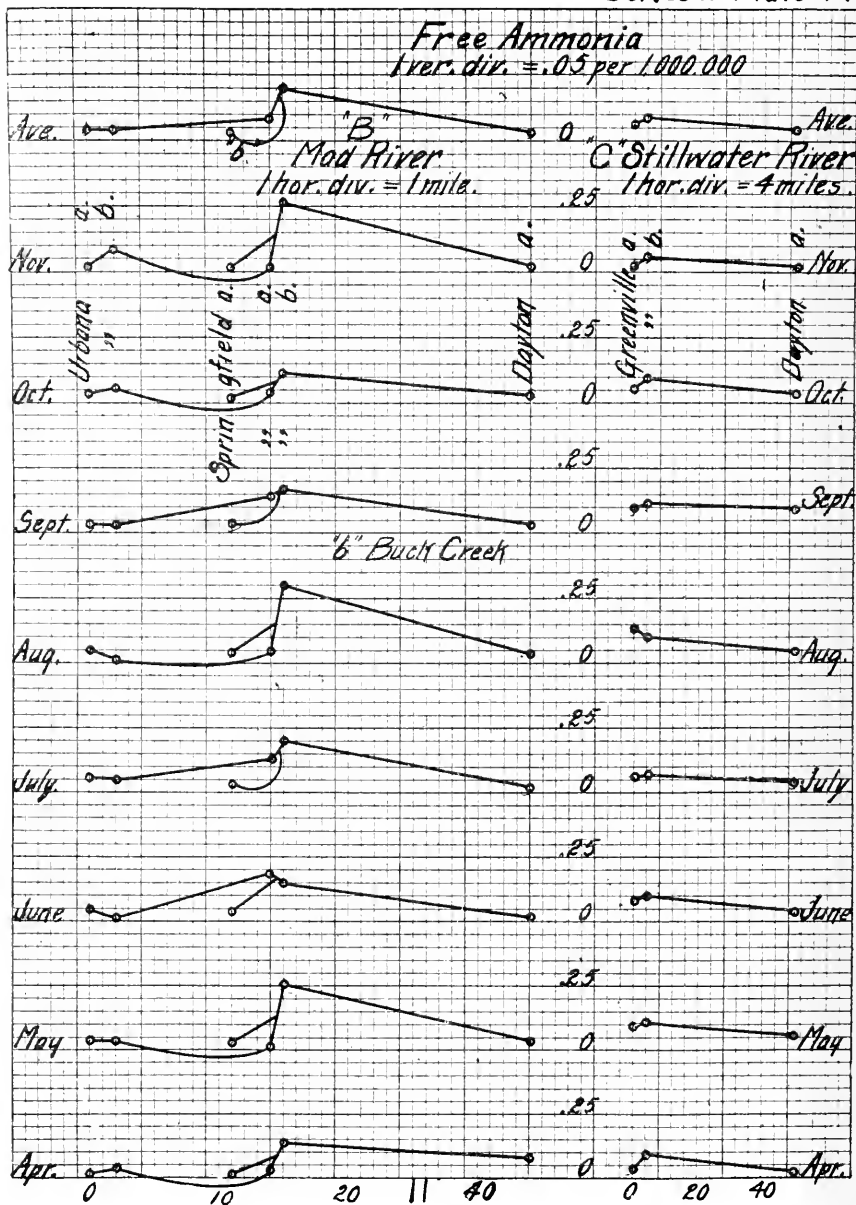
Series 2 Plate 12



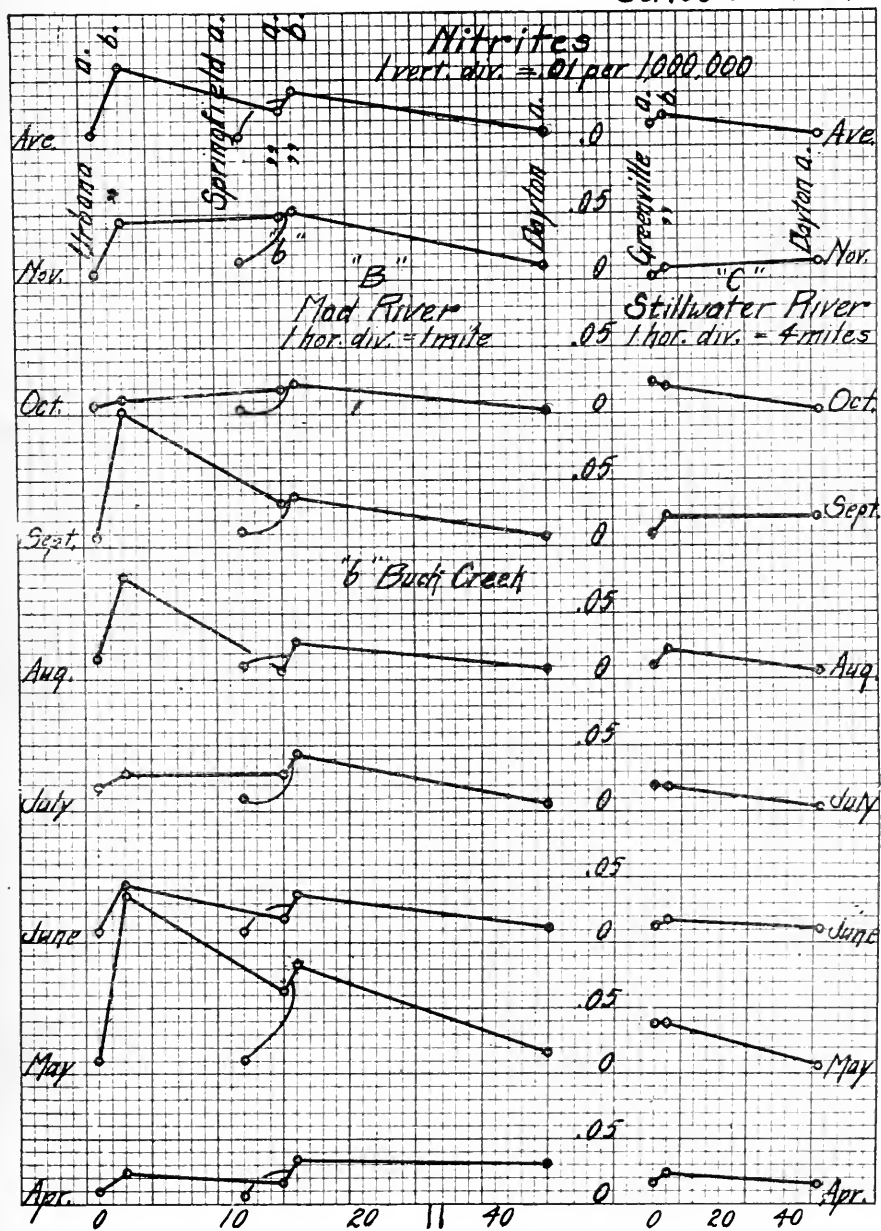
Series 2 Plate 13



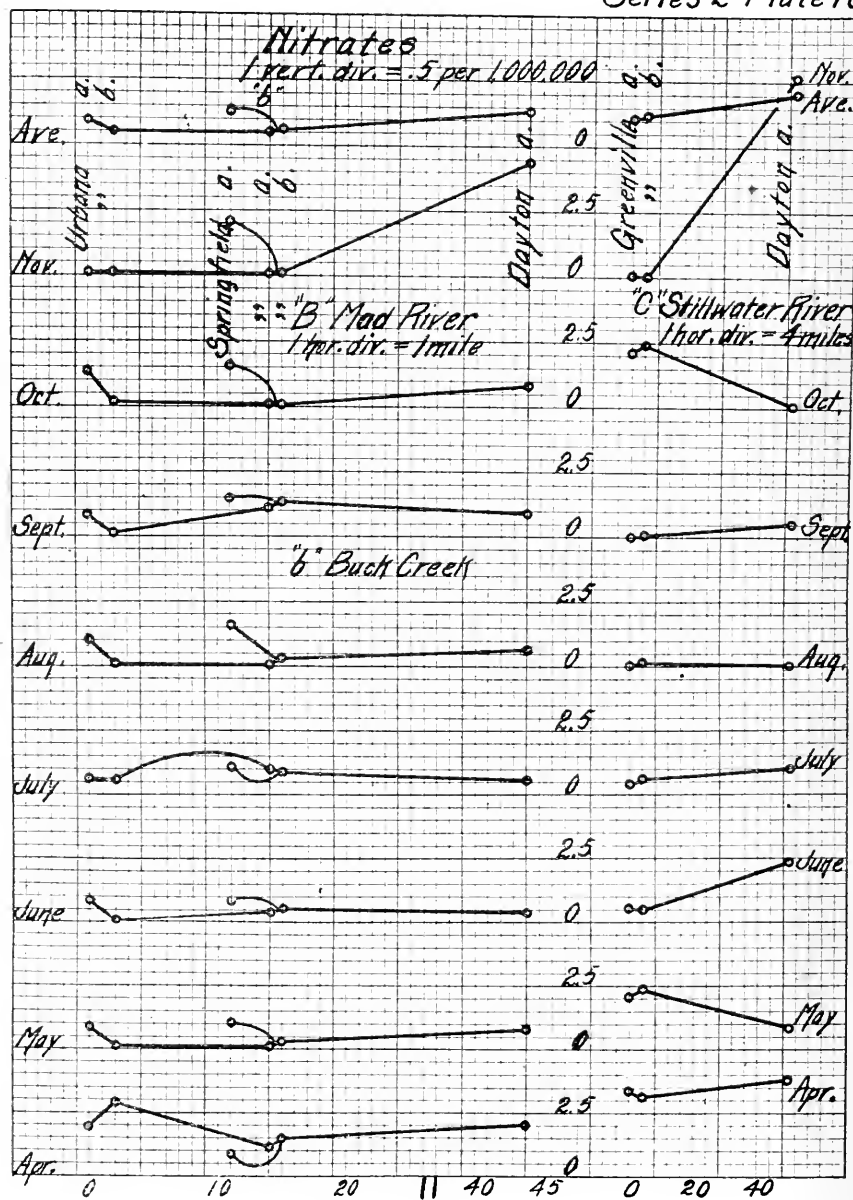
Series 2 Plate 14



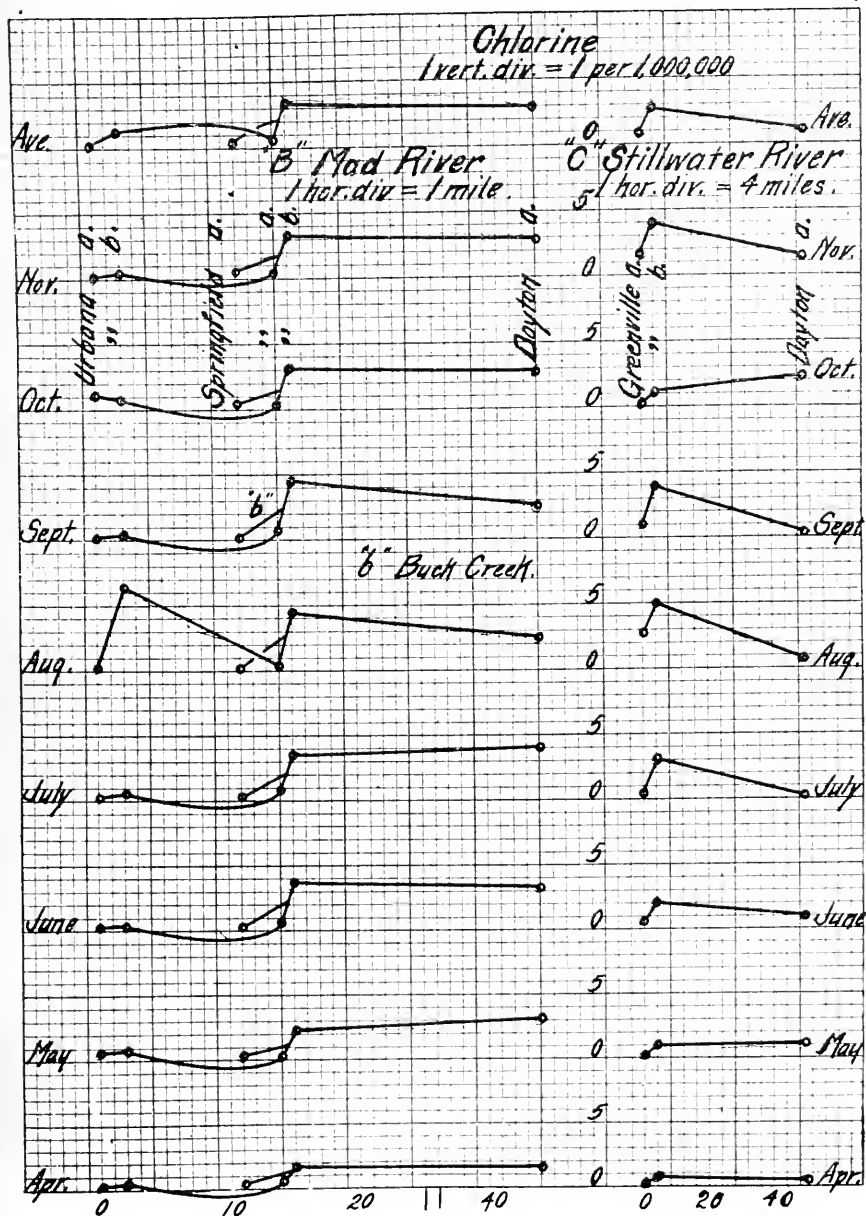
Series 2 Plate 15



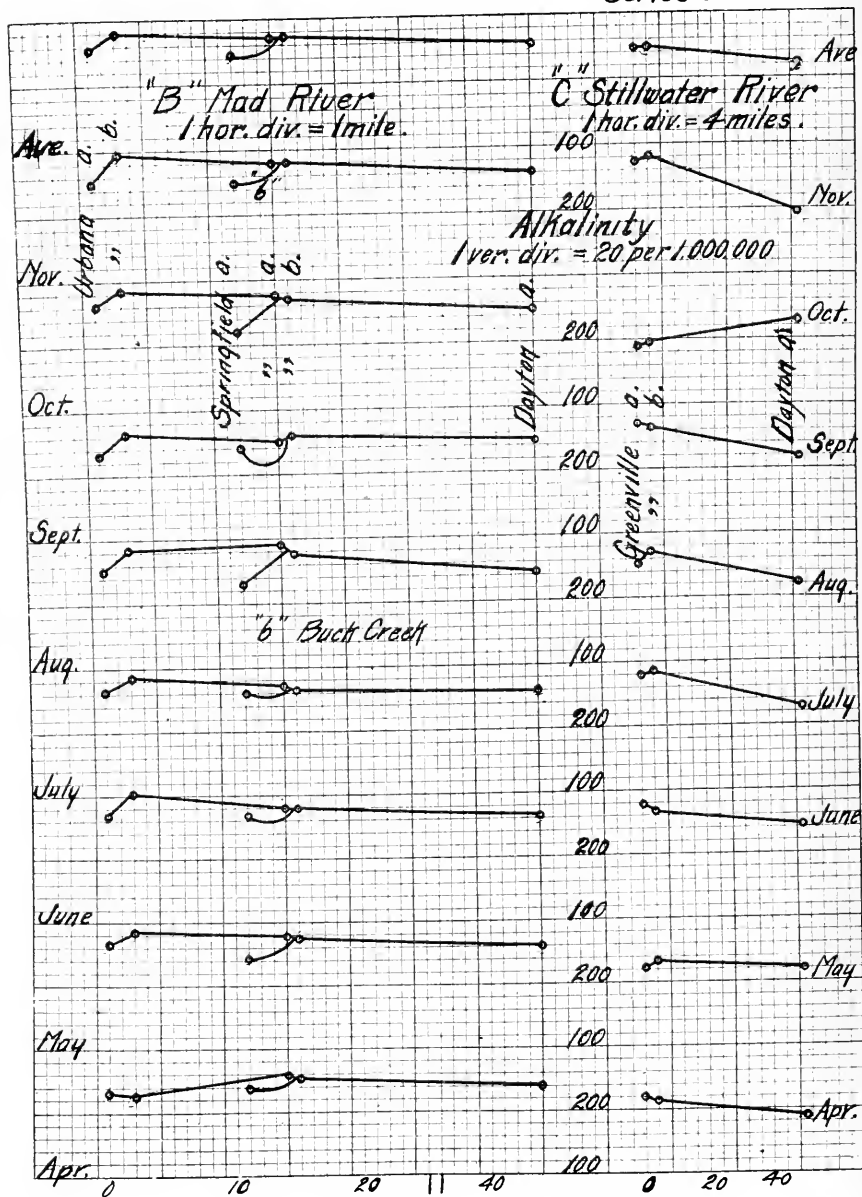
Series 2 Plate 16



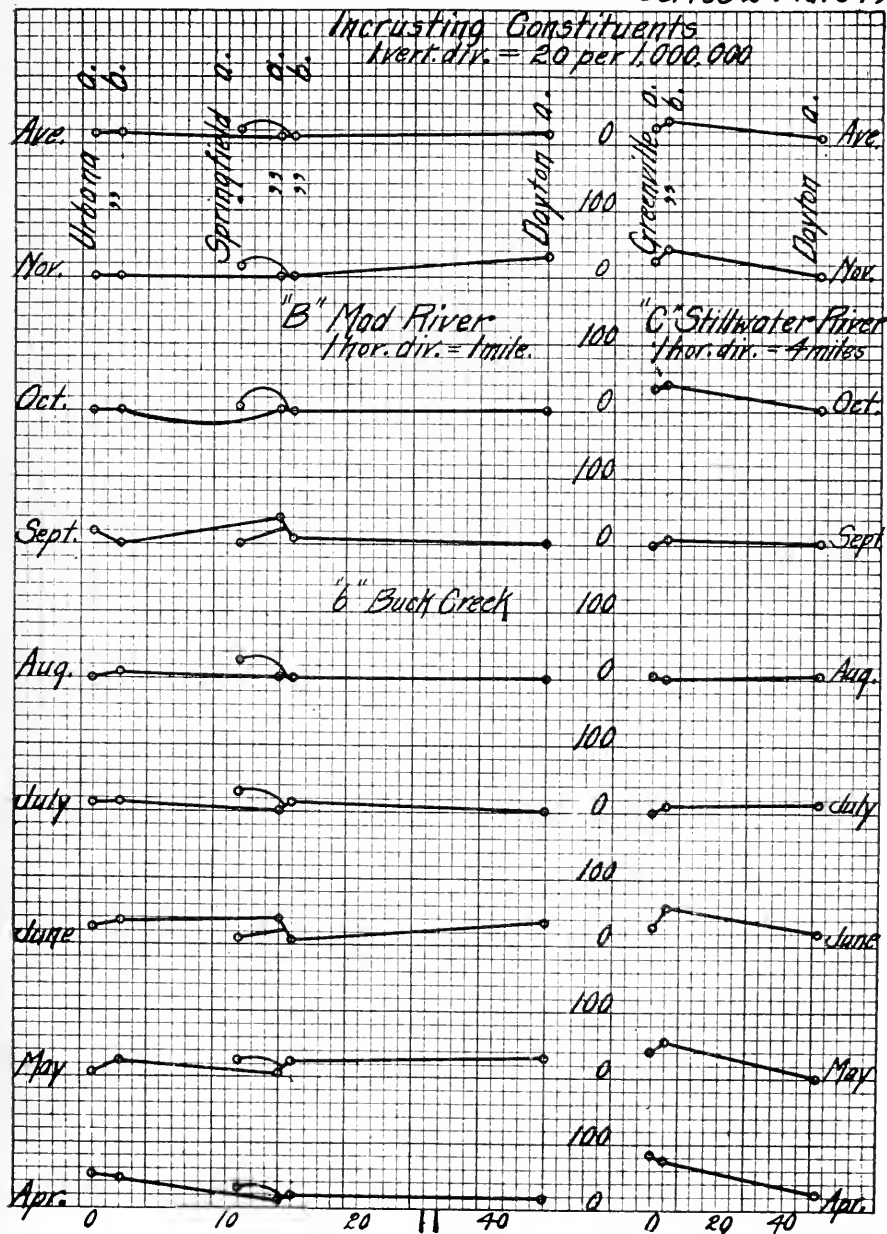
Series 2 Plate 17



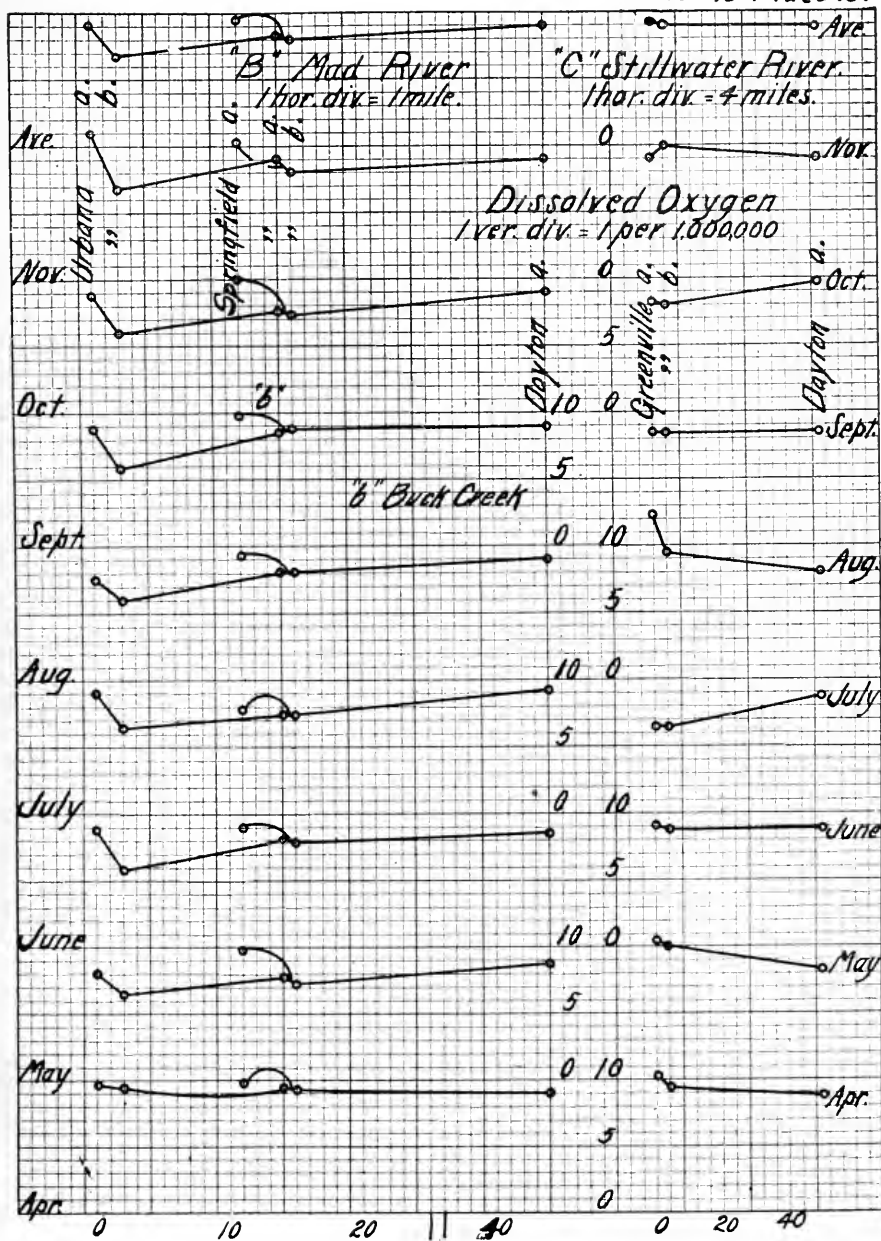
Series 2 Plate 18



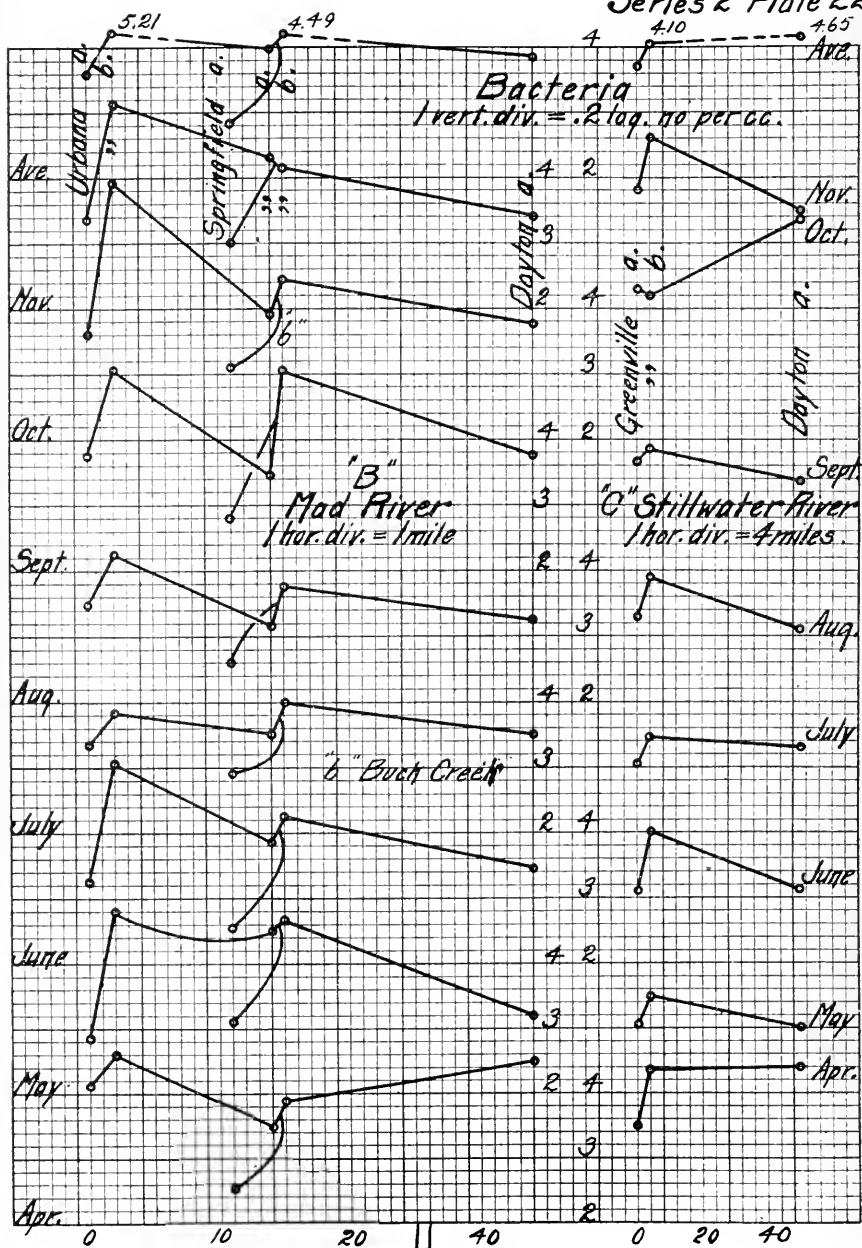
Series 2 Plate 19

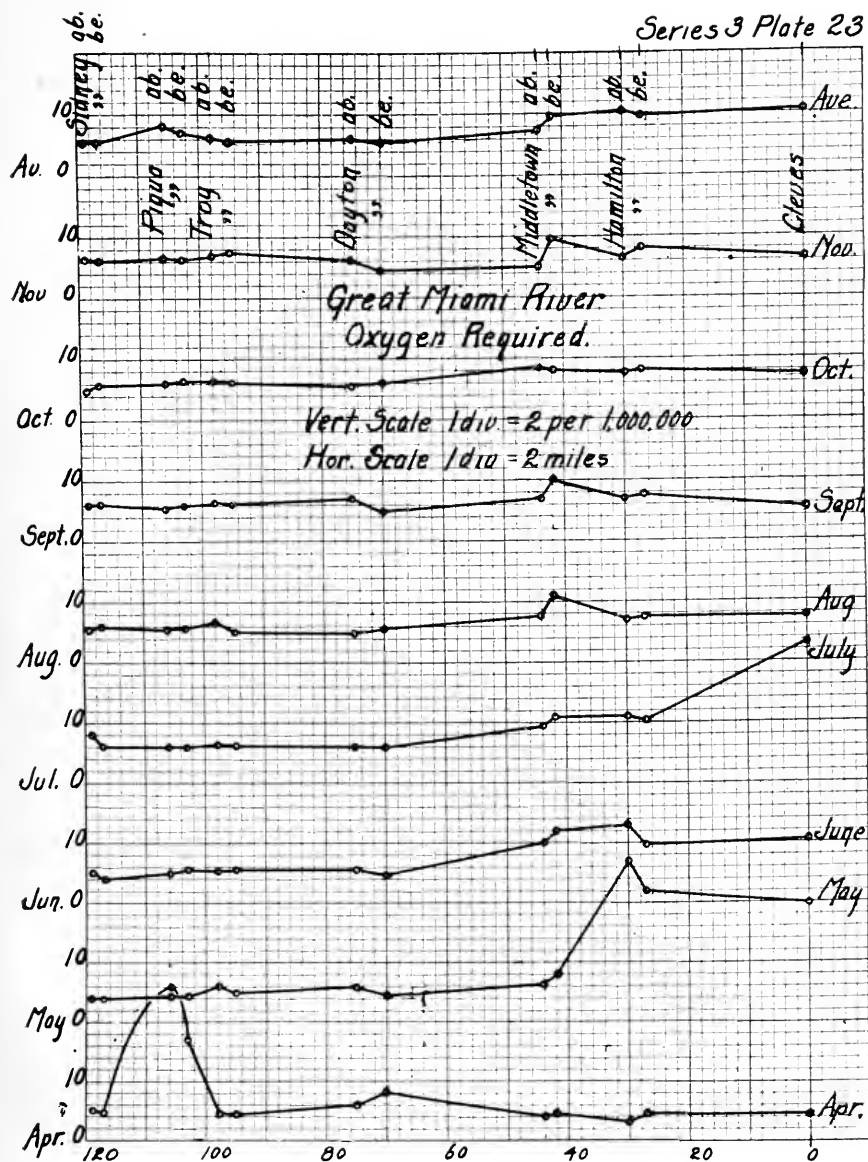


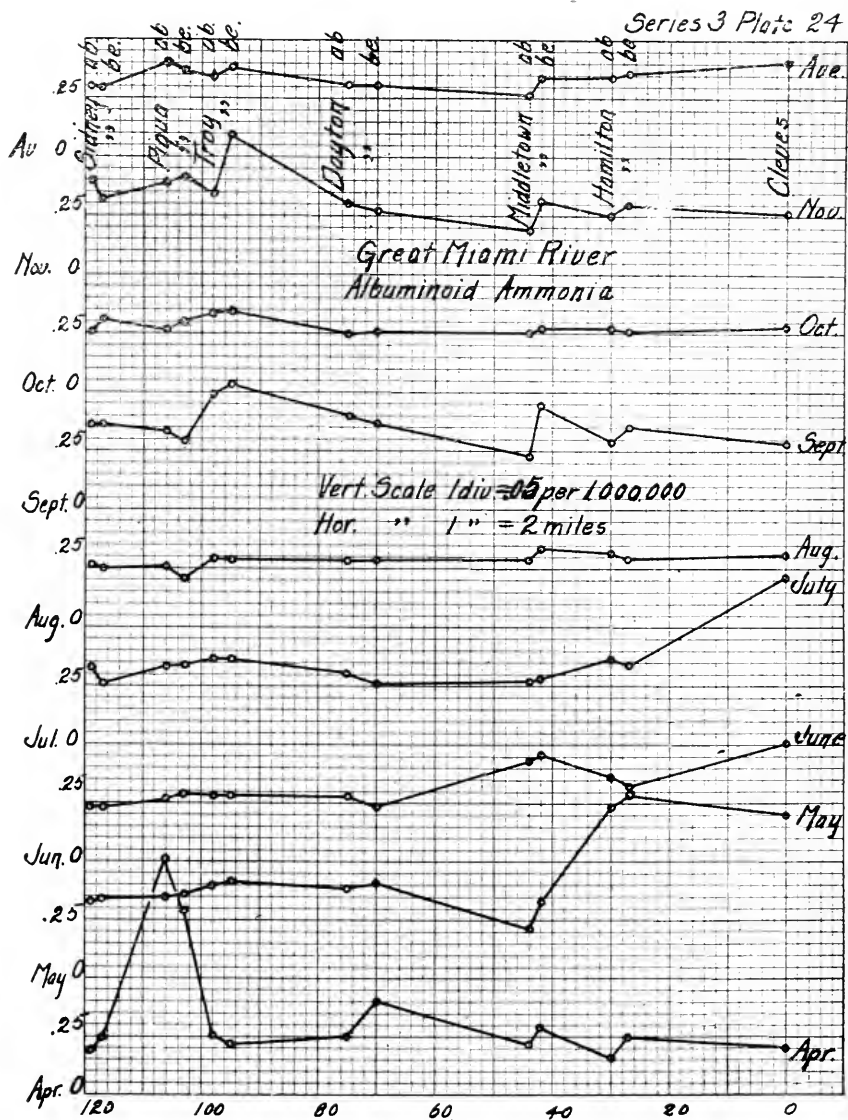
Series 2 Plate 21



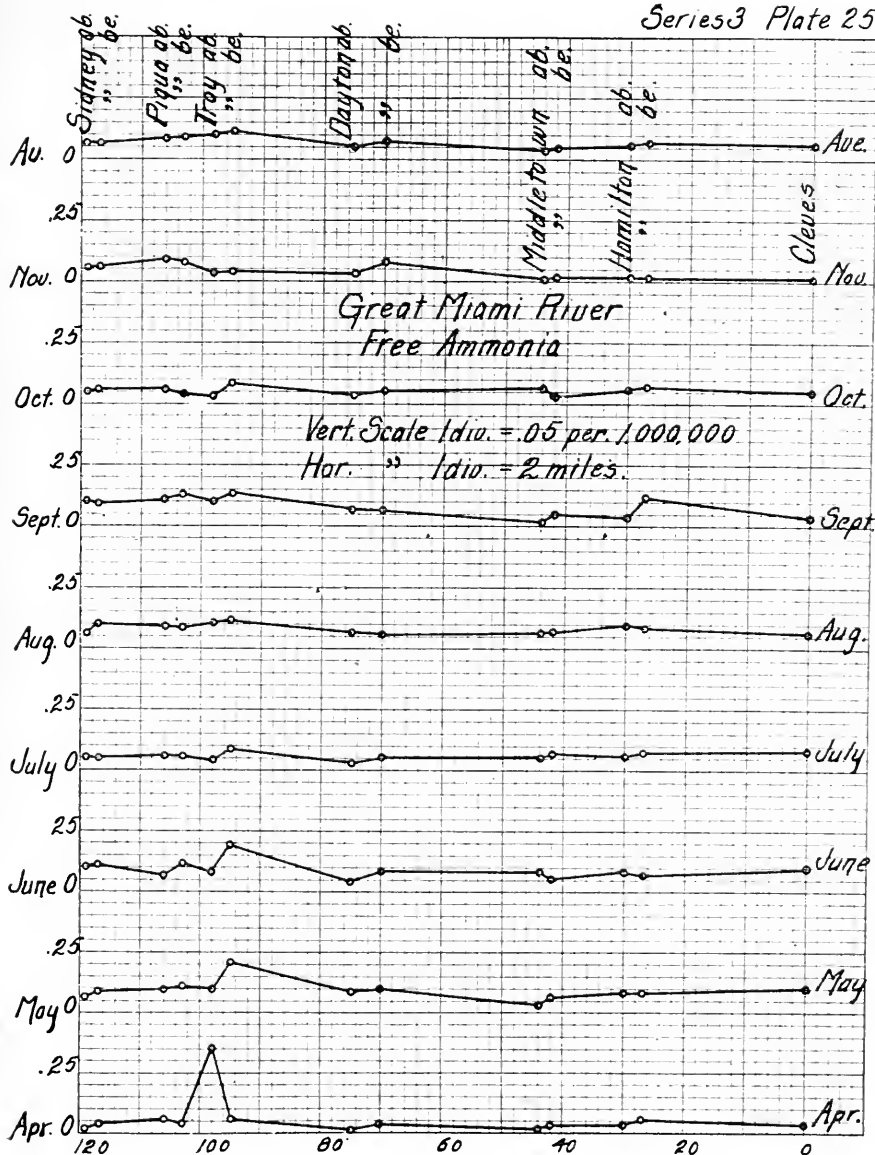
Series 2 Plate 22



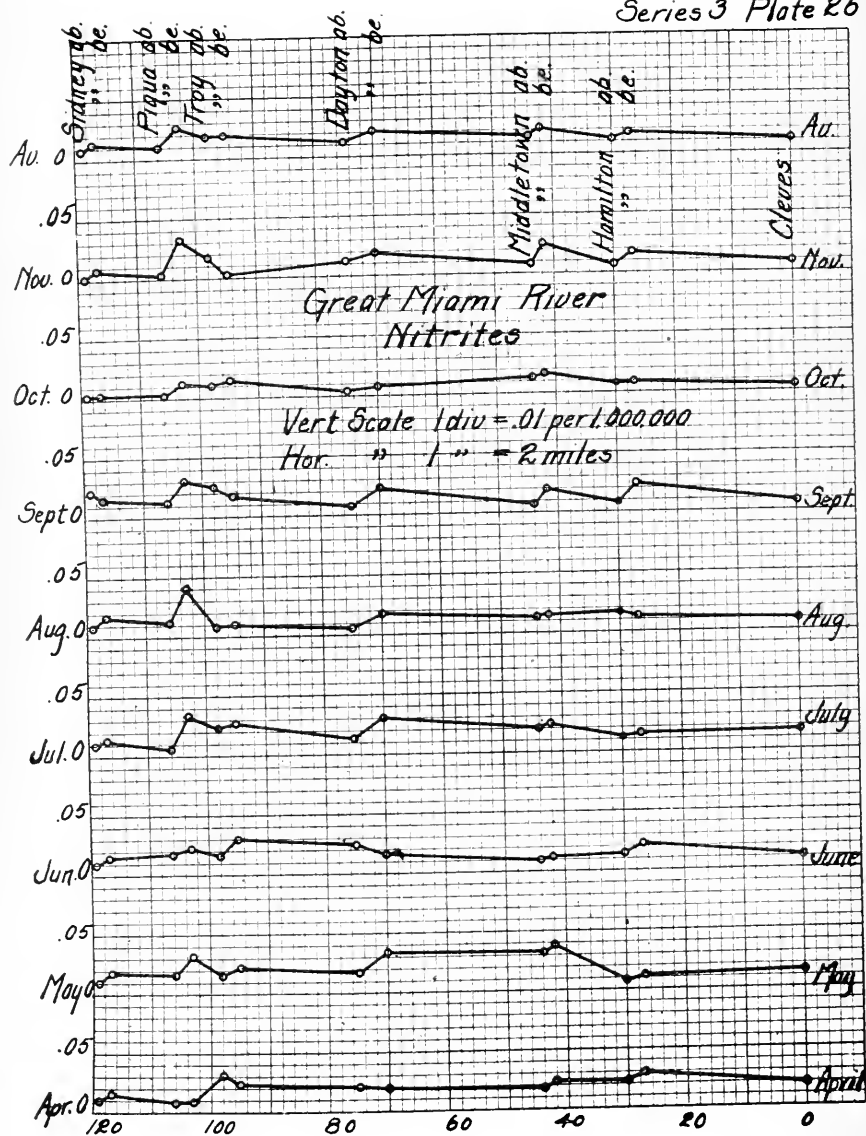


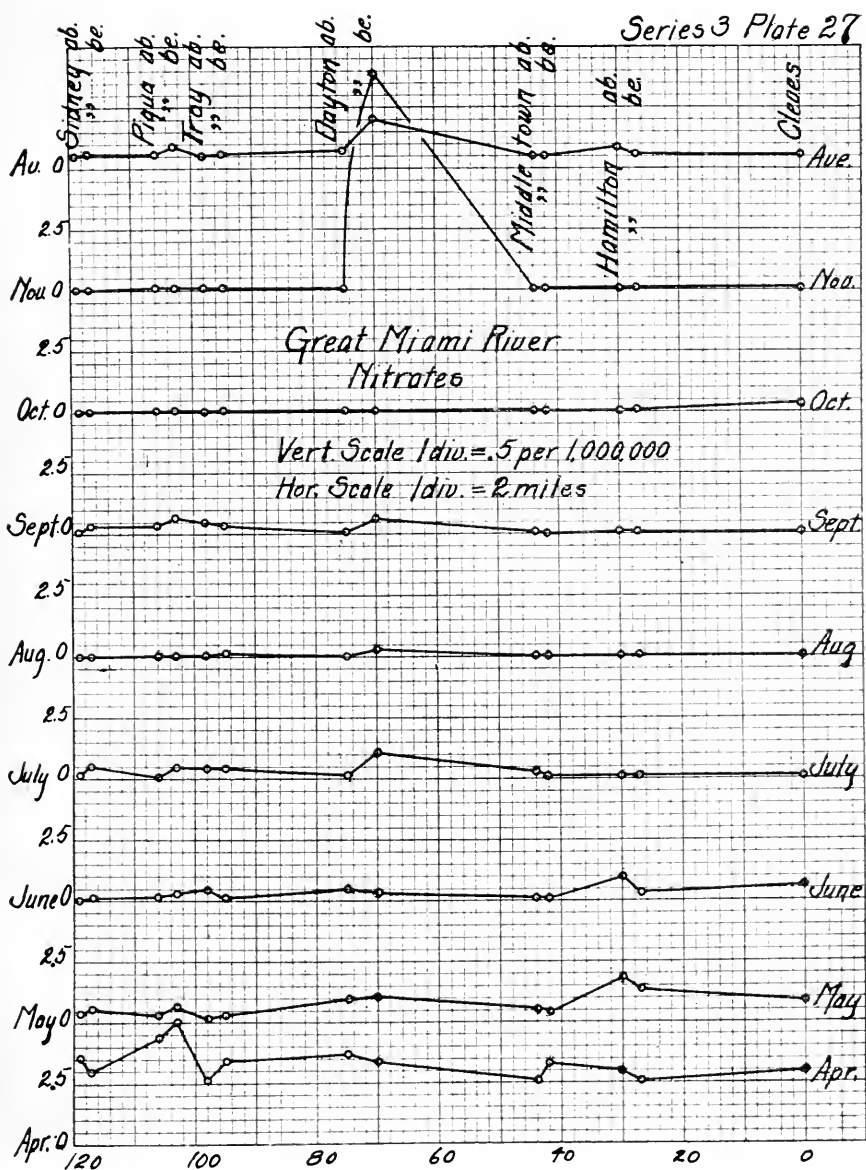


Series 3 Plate 25

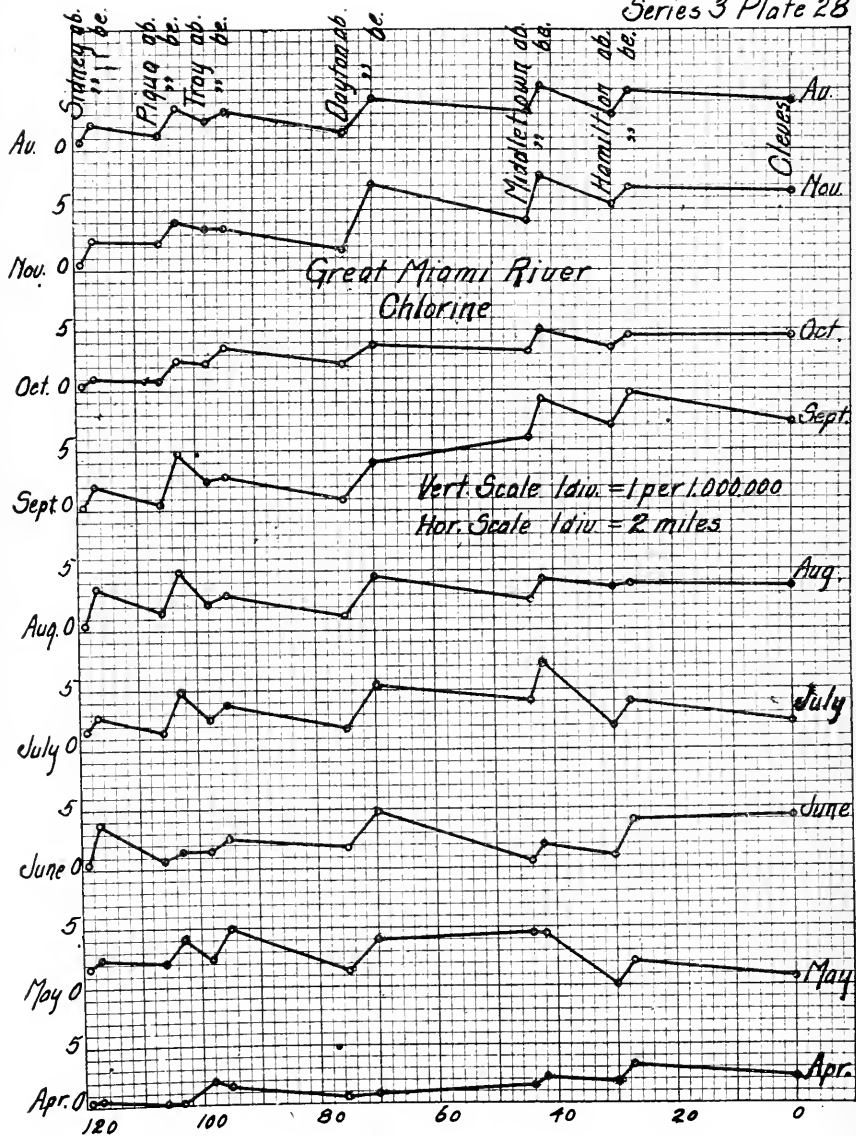


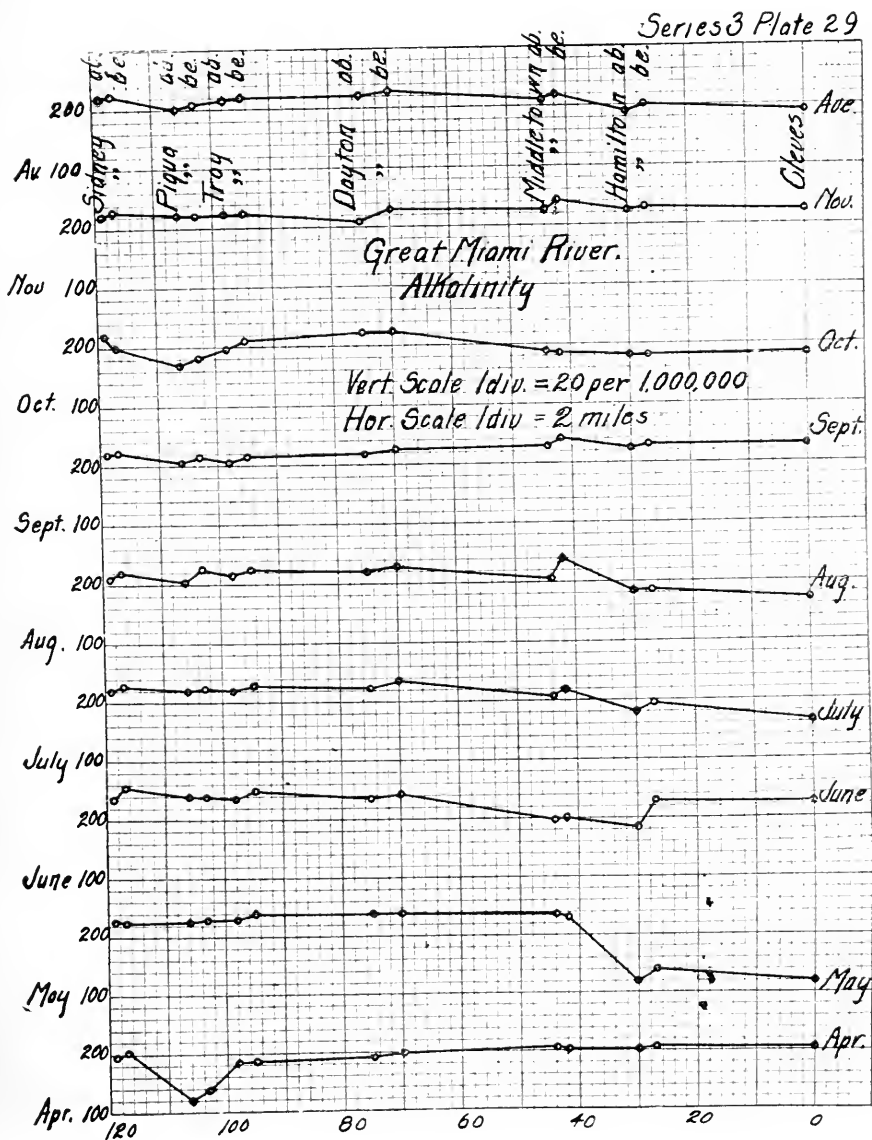
Series 3 Plate 26

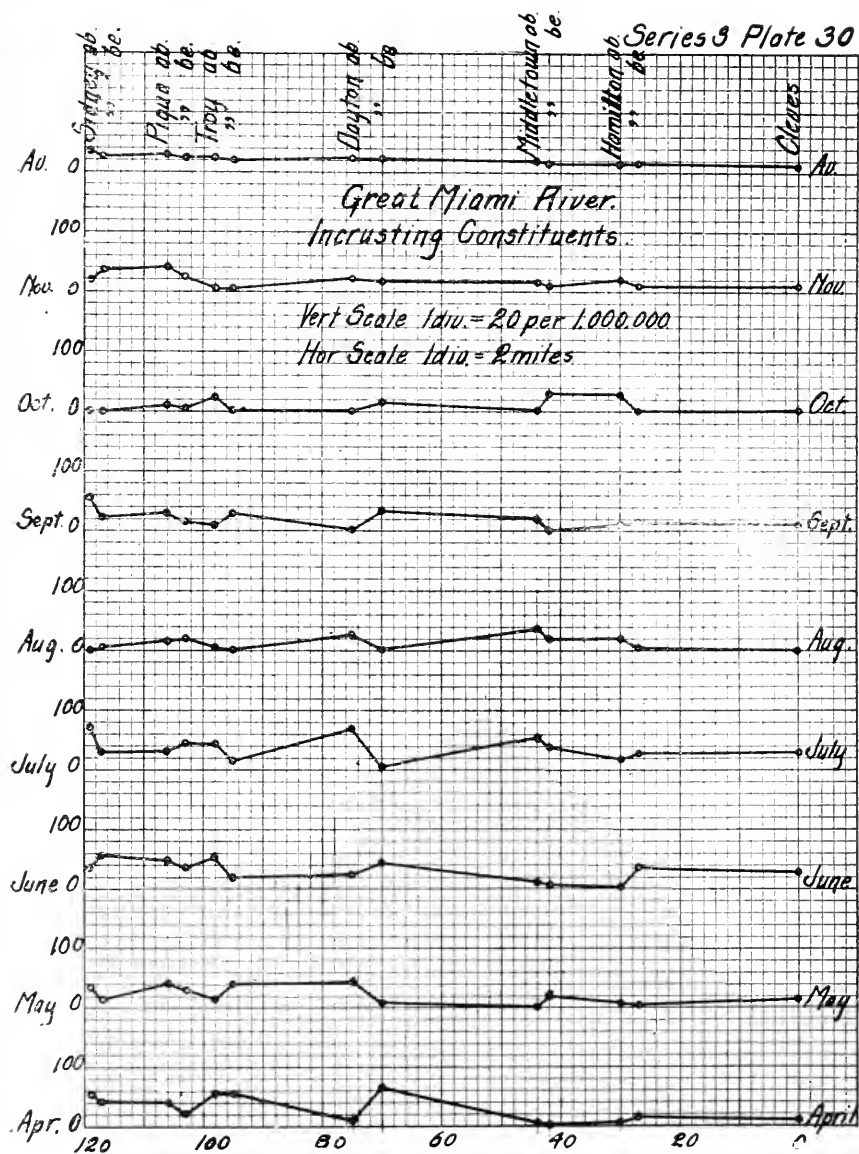


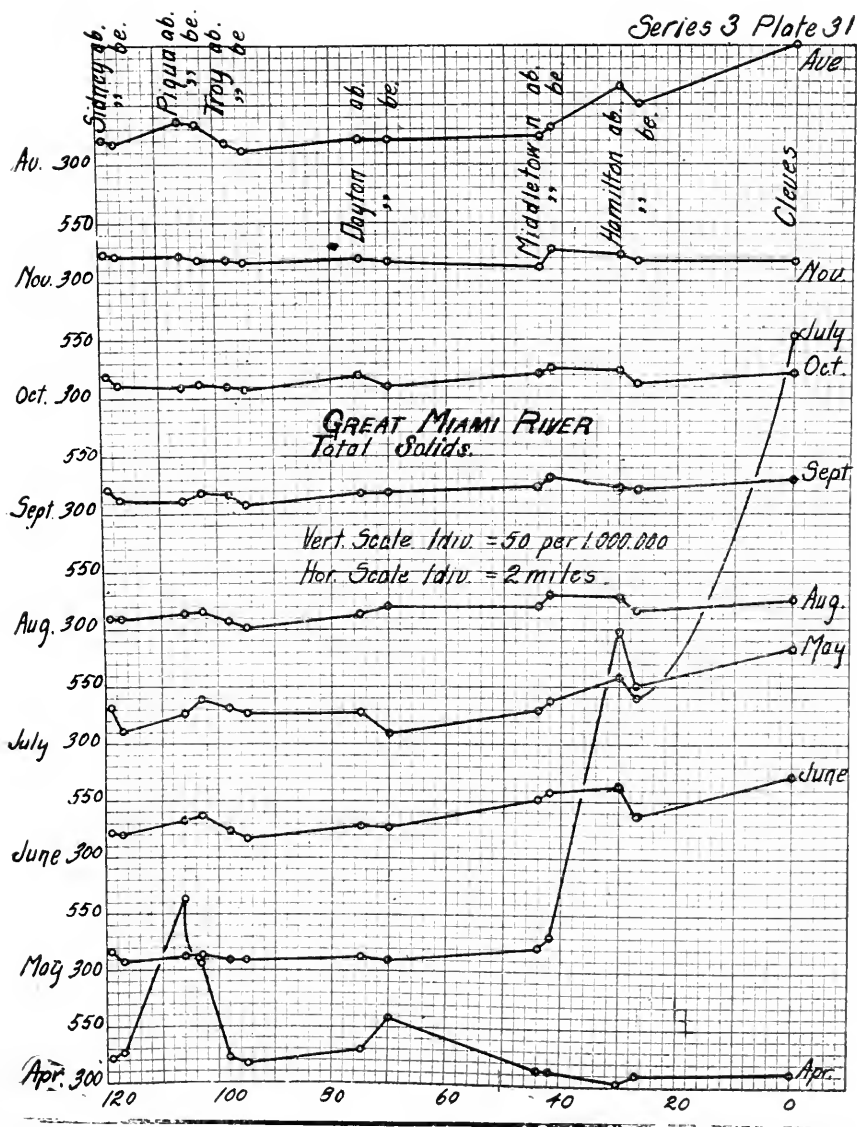


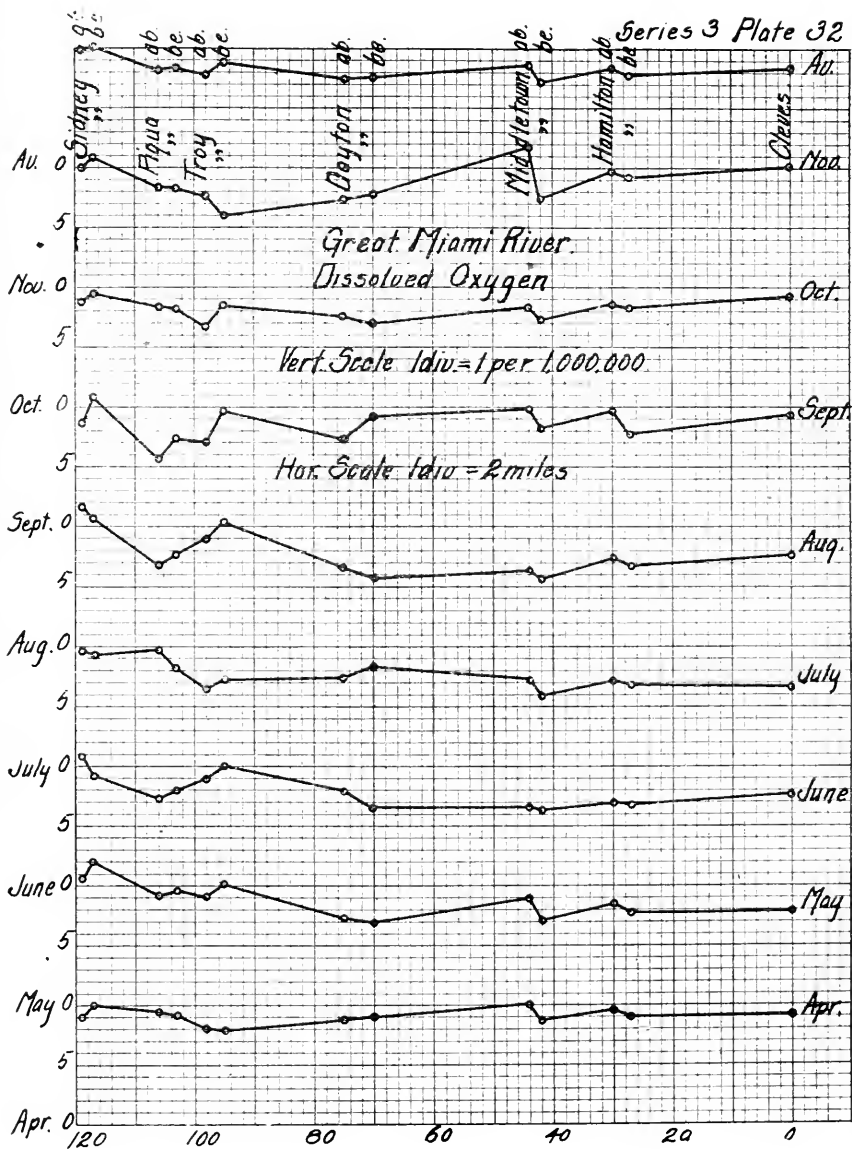
Series 3 Plate 28











Series 3 Plate 33

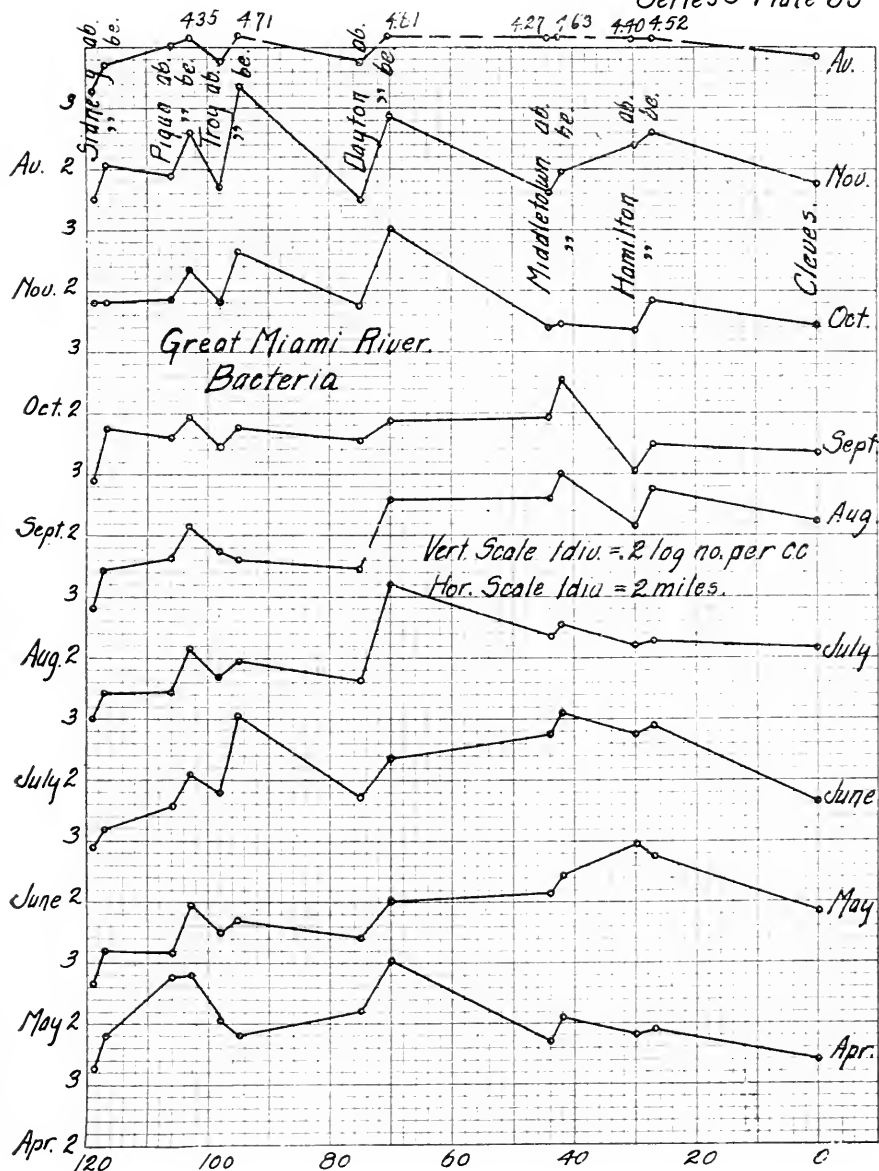
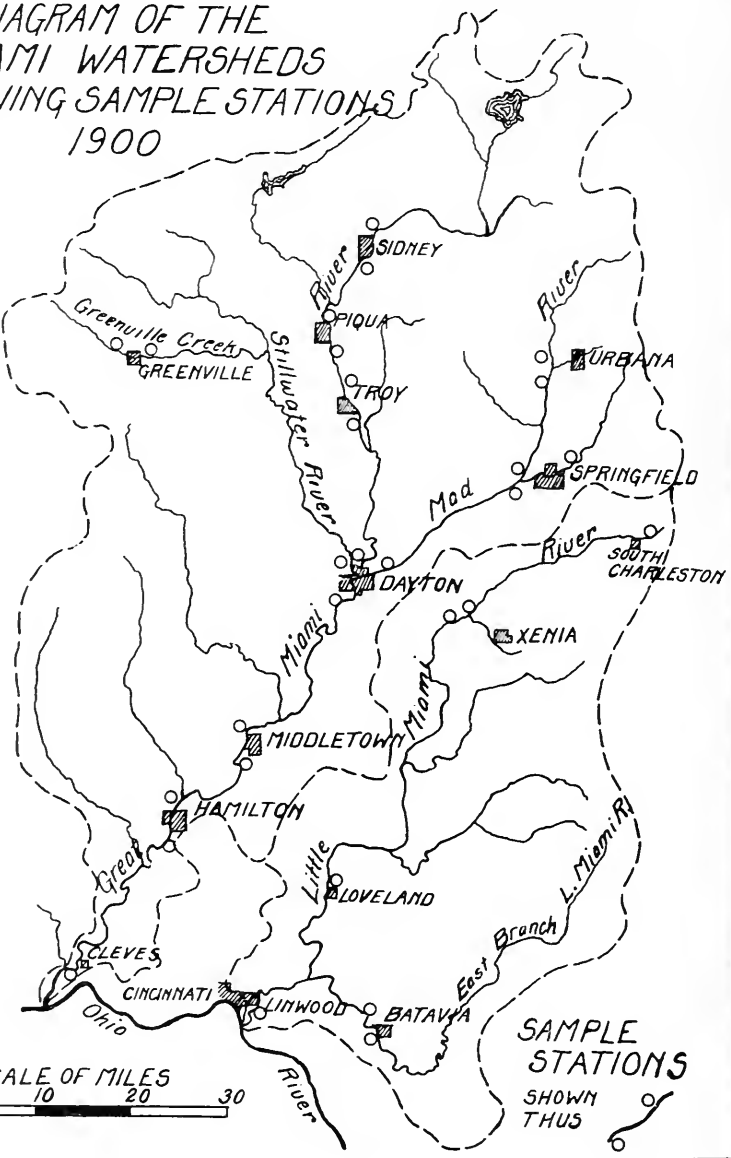


DIAGRAM OF THE
MIAMI WATERSHEDS
SHOWING SAMPLE STATIONS
1900



VIII. DISCUSSION OF ANALYTICAL RESULTS.

* 1. LITTLE MIAMI RIVER.

Seven sampling places were made on this stream and located as follows: Above South Charleston on one of the headwater branches; above Xenia, below Xenia, above Loveland, and opposite Linwood; all on the main stream, and above and below Batavia on the East Fork of Little Miami River. This fork empties into the main stream some ten miles above Linwood. The South Charleston station was not established in April, and no September sample was taken there as the stream was dry except for a few pools.

Physical Properties. The waters of the Little Miami River presented rather inferior results in regard to appearance. The majority of the samples contained a considerable sediment, and while only a few (from the lower portion of the watershed) showed high turbidities, yet none of the samples were clear. In only one sample could the wire of the turbidity stick be seen at a depth of more than 10 inches. The waters always possessed a noticeable odor, and this odor was of a vegetative nature in most cases. The waters of the Little Miami occupy an intermediate position among the river waters of the state as regards color. The upper waters of the watershed were found slightly more colored than those nearer the mouth of the river.

Oxygen Required and Albuminoid Ammonia. Plates 1 and 2. These determinations are considered together as their fluctuations in the Little Miami are due chiefly to the vegetative organic matter in the water and not to sewage. The oxygen required and the nitrogen as albuminoid ammonia were nearly always high, indicating a large amount of vegetative material. The lowest findings were obtained at Loveland and Linwood. On the other hand the May and July findings at the latter place were the highest found for the season on this river, and were the result of heavy rains. The tributaries at Linwood in May and July were also extraordinarily high. It is to be noted that the rain-falls and the dates of sampling happened to stand in such relation to each other as to cause marked results to appear only at Linwood.

The generally high findings at Batavia show a goodly amount of vegetative matter in the East Fork, and indicate the wisdom shown in filtering the water of that branch before it is used for the public supply of the village named. This undesirable vegetation, as well as suspended silt and clay, is readily removed by a proper filtration.

The findings above Xenia in July indicate a slightly larger proportion of vegetative matter than usual. That the oxygen requirement and albuminoid ammonia findings were not still higher each month above Xenia, on account of the effluent from the strawboard factory at Cedarville, is doubtless due to the fact that, after leaving the reservoir, the effluent has a flow of several miles in Massick's Creek and then enters

the main stream some distance above Xenia, and therefore the above determinations are reduced by oxidation, precipitation, and dilution to the point shown.

At South Charleston the river is a mere brook and for some distance above the sampling place, as was subsequently learned, it is overhung with weeds and grass while it slowly finds its way through fields and pasture land. It is therefore not strange that these determinations were found to be high at this place.

Nitrogen as Free Ammonia. Plate 3. The absence of marked sewage pollutions is shown by these curves. The sewage from the Clermont County Infirmary causes a small increase in free ammonia below Batavia. A considerable amount of free ammonia was present at South Charleston and at first thought it might be attributed to barnyard drainage, but the chlorine does not correspond, and the cause rests in the local pollution along the banks above the sampling place.

At Xenia the water above the town is ordinarily high enough in free ammonia to fail to be increased by the water from Shawnee Run. The city of Xenia is but little sewered and so Shawnee Run carries but little sewage, although some is present as shown by the various findings.

Agreeing with the chlorine findings there is a slight increase in the nitrogen and free ammonia between Loveland and Linwood.

Nitrogen as Nitrites and Nitrates. Plates 4 and 5. As usual the lowest findings were obtained during the dry weather months toward fall. The results indicate no great past pollution which had not been overcome, and this is especially true of the East Fork water at Batavia. In the earlier months of the investigation the results on the main stream were higher as a result doubtless of farm drainage during cultivation, since manures and soil enrichers are used in this section of highly cultivated land.

The general high nitrites at Xenia are attributable not to that city alone, but have their source in material introduced farther up stream, partially at the Cedarville strawboard factory and partly from other sources.

Chlorine. Plate 6. These curves serve as the best indicators of sewage influences on the stream, since the chlorine was less disturbed by local factors than the determinations for nitrogen, for oxygen required, and for bacteria. The general low chlorine findings show the absence of specific sewage pollutions as well as of the decided mineral pollutions which have been recorded in some of the previous investigations of the streams of the state. The maximum chlorine averages for the season on the Little Miami were at Linwood and below Xenia, each being 2.3 parts per million. As might be expected the chlorides were generally higher in the fall months when the volume of water in the river was least.

The slight sewage influence of Xenia is shown by the rise in each curve at the point representing the entrance into the Little Miami River

of Shawnee Run, which carries the sewage of the city. By reference to the accompanying report of the Engineer of the Board it is seen that, aside from the Ohio Soldiers and Sailors Orphans' Home, a very small proportion of the people of Xenia have access to the sewers, and consequently a much smaller sewage influence is exerted on the stream by that city than one might think if only the number of inhabitants were considered. The sewage from the Home is not supposed to reach the river by way of Shawnee Run except in occasional instances.

The slight increase in chlorides at Batavia is indicative of a small amount of sewage from the County Infirmary plus some surface drainage from the village. It is noticed that the chlorine findings above and below Batavia are much higher in April, October and November than during the summer months. This peculiarity may be somewhat influenced by the wintering of a large number of steers on the bank of the river above Batavia at the town of Lynchburg. (See Engineer's report under Lynchburg.) The steers begin to arrive early in October and are sold in the spring. Owing to the crooked course of the stream, Lynchburg is nearly fifty miles from Batavia by river, and organic matter has opportunity to be disposed of but the chlorides remain.

At South Charleston the stream usually contains little or no chlorine, but departures occurred in July and November. Such departures in a stream of moderate size might mean something, but in so small a branch of quiet flow as the one at South Charleston a minor local factor could produce distinct changes in the analytical figures.

The diluting effect of the heavy rains is seen in the May and August samples at Loveland and Linwood, and again at the latter place in July.

Alkalinity and Incrusting Constituents. Plates 7 and 8. The amounts of incrusting material were fairly constant throughout the Little Miami River and were lower than for any of the streams of the state previously studied. The head waters were more alkaline than those of the southern portion of the watershed, as shown by the general dip of the curves from left to right. Although the southern samples were somewhat more influenced by rainfalls than the northern samples, yet it remains true that the northern area yields the harder waters. The waters of East Fork were lower in alkalinity than those of the main stream, the averages for above and below Batavia being 135.1 and 139.5 respectively, while the averages on the main stream varied from 167.8 at Linwood to 249.1 above Xenia.

As Batavia has recently (October, 1900) installed a public water supply, using the river water after mechanical filtration, and as their process of treatment involves the use of a coagulant, it is well to consider the alkalinity obtained above Batavia. The coagulant is decomposed by the carbonates and bi-carbonates and hence there should not be too low an alkalinity otherwise undecomposed coagulant might appear in the effluent—a condition which should not occur. The lowest alkalinity above Bata-

via was 80.0 (obtained in high water) and this figure gives a good margin of safety for the proper and intelligent operation of the filter plant.

Diluting influences from rainfalls are best seen at Linwood in May, July and August.

Total Solids. Plate 9. The solids were rather lower than usual for Ohio streams and were fairly constant throughout the watershed barring the excessive amounts of clay borne in the high waters at certain sampling periods. As stated in the previous section the head waters were slightly harder, but this was compensated for, as regards total solids, by the increased amounts of suspended matter in the water of the lower portion of the watershed. Agreeing with the hardness the solids of the East Fork were lower than those obtained on the Little Miami River proper.

Dissolved Oxygen. Plate 10. These curves by the dips at Xenia and Batavia show the addition of some organic matter. Some rather low results were obtained at South Charleston when the water was low. On the whole the results for the stream are low indicating an amount of oxygen below the normal.

Bacteria. Plate 11. In general the bacterial results agree with other findings in showing a slight sewage influence below Batavia. On the other hand, while some sewage enters the river between the two sampling places at Xenia, its presence is not indicated by the course of the bacterial curves. This is an unusual occurrence and is due to the abnormally high number of bacteria at the sampling place above Xenia. In considering the effect of the strawboard factory refuse introduced at Cedarville, and which caused the bacterial disturbance just referred to, we noticed here, as in other streams where similar conditions existed, that on the mixture of strawboard factory wastes with river water a great increase in the number of bacteria occurred, and further that this high bacterial content of the stream persisted longer than the chemical evidences of the specific pollution. It appears that microbic life finds under those conditions a favorable environment and hence propagation of certain species rapidly ensues.

The findings at South Charleston are higher than might at first be expected, but they agree with the other results in indicating considerable organic matter, and in addition it should be noted that all the samples at this station save one, were affected by local rains. The low finding at Xenia in July is responsible for the downward course of the curve from South Charleston.

The relatively low number of bacteria at Xenia in June, July and September give an intimation of what might be expected with cessation of the specific pollution from the strawboard factory at Cedarville. The high number of bacteria in the remaining months at Xenia is due to this pollution and is not indicative of sewage or the usual effect of surface washing.

The May samples exhibit the most uniform rain influences on the stream, while the July result at Linwood produces the greatest inflection in the bacterial curves due to precipitation causes.

The stream as a whole is rich in microbic life—especially so, for so small an amount of sanitary sewage. In one sample above Batavia there were 750 bacteria per c. c., but the next lowest finding in the 52 samples bacterially examined was 1200 bacteria per c. c. In 75 per cent. of the samples there were upward of 2,000 bacteria to c. c.

SUMMARY FOR LITTLE MIAMI WATERSHED.

The average composition of the water of the Little Miami River including the East Fork is as follows computed from the averages at our seven stations:

Color .....	.29	Chlorine	1.6
Turbidity .....	.52	Alkalinity	197.8
Oxygen required	6.32	Incrusting constituents	15.
N. as albuminoid ammonia...	.329	Total solids	387.
N. as free ammonia.....	.100	Dissolved oxygen	7.86
N. as nitrites.....	.018	Bacteria per c. c.....	23900.
N. as nitrates.....	.27		

The station established at South Charleston to determine the purity of the headwaters was of little value as the samples there happened to be too much influenced by local rains, in addition to local pollutions which greatly affected so small a stream. The grossest pollutions occur at or near the headwaters and hence the question is, "Does the water attain a reasonable degree of purification?" On the main stream the best water is in the lower course and is possibly as good above Loveland as anywhere, and yet its character is not such at that place as would entitle it to consideration for a public water supply without treatment of some nature.

The accompanying report of the Engineer of the Board says that the conditions at Lynchburg are very bad in the winter, but with the cause of the trouble removed in the spring the evil effects on the stream are lessened. The analysis at Batavia show that from April to November the Lynchburg pollution had been well purified by the time the water reached the first named village. Batavia has just introduced a public water supply, taking the water from the river and treating it by mechanical filtration, thus adding artificial to natural methods of purification in the securing of a water of good quality.

With the water of the East Fork of the Little Miami River possessing some desirable features as shown by our analyses, and with the undesirable characters removed by the proper operation of their filter, the citizens of Batavia should be supplied with a very acceptable water and one whose use for domestic purposes should, from a sanitary standpoint, quickly supplant the waters derived from private wells in the village.

In regard to the suspended matter the Little Miami is worthy of mention, for the results obtained during 1900 indicate that its waters are seldom clear under ordinary conditions of weather, and at times of rain it becomes a turbid stream and exceedingly so in the southern portion.

As a whole the Little Miami River is comparatively free from sanitary sewage, but it receives manufacturing sewage, and contains so much organic matter of a vegetable nature, especially in its upper waters, that purification is somewhat retarded, and would be more so with grosser pollutions. Accordingly the Little Miami River does not rank well among streams as regards ability to care for pollutions by natural purification. On this account it is well that the sewage of Xenia (which city is about to be sewered) is to be filtered before it is emptied into Shawnee Run a short distance above the point where that tributary enters the main stream.

Sampling stations were not established on Massick's Creek, but when the writer saw that stream in June its condition was foul. Bubbles of gas were rising to the surface of the liquid and a test showed the entire absence of dissolved oxygen. As is stated in the Engineer's report Massick's Creek is but little more than an open sewer, by which a little surface drainage from Cedarville and a larger amount of strawboard factory drainage reach the Little Miami River.

As regards hardness the waters of the Little Miami occupy an intermediate position in Ohio, though perhaps no softer than the average. Some other streams have shown lower alkalinities but none thus far studied have been lower in amount of scale forming material, and with the suspended matters removed these waters could be used for boiler purposes, although sludge would form and need to be removed.

2. GREAT MIAMI WATERSHED.

This portion of the work will be considered in three divisions, viz: Stillwater River including Greenville Creek, Mad River including Buck or Lagonda Creek, and the Great Miami River proper.

a. STILLWATER RIVER.

There were three sampling places on this portion of the Great Miami, two being located near Greenville on the creek bearing that name, the upper one above town and opposite the water works, the other below town. The third station was on Stillwater River, a short distance above its mouth.

Physical Properties. In color the samples were quite uniform. None of the samples were free from suspended matter as all deposited noticeable amounts of sediment and about 30 per cent. of the samples showed considerable sediment, but they did not carry the large amounts of clay found elsewhere on the Great Miami system. The highest turbidities from the Stillwater basin were found at Dayton in April and at Greenville in October, both being caused by recent sharp rains. The April sample below Greenville was taken shortly after the commencement of a heavy rain, but insufficient time had elapsed to allow much of an increase in turbidity. Doubtless turbidities greater than .40 do occur at times but they are of short duration in a stream like this, and a further study of the rainfall table, the dates of sampling, the local conditions, and the turbidities

obtained indicate that this tributary does not attain excessive turbidities. However, the results indicate that the waters of the Stillwater basin do not become extra clear under ordinary conditions. The lowest finding was at the Greenville station in November when no rain had fallen for ten days, but even then after a dry period in a dry fall the turbidity wire was visible only at a depth of twelve and one-half inches.

Most of the samples had a vegetative or earthy odor while none were odorless.

Organic matter as indicated by findings for *oxygen required* and for *nitrogen as albuminoid ammonia, free ammonia, nitrites, and nitrates*. Plates 12-16.

It is seldom that the effects of surface washing after rains are so well shown as in the Stillwater curves and determinations for the oxygen requirement. This is due in part to the otherwise minor departures from the normal. Excessively large amounts of carbonaceous matter are not met with at any time, but the direct rain influences are noted at Dayton and also in a lesser degree at the station below Greenville in April, and again at both Greenville stations in October. The July and September curves had upward tendencies as the result of minor additions from rain-falls at Dayton and their absence at Greenville.

The albuminoid ammonia results give in a slightly lessened degree the same indications as do those just discussed. The ammonias are higher than in some of the better streams, but the rise in these curves as well as in those for nitrites and oxygen required point to the addition of some sewage at Greenville. In August most of the curves descend at Greenville owing to some unusual pollution above the city. This was not found again.

All the nitrites at Greenville were high save in November, and they had not disappeared in Dayton except in October, although nearly so in July. The upward course of the nitrite curve between the Greenville stations was reversed in May, July and October, due to the unusually high readings above town. The nitrites of the stream were generally high for an open watercourse which was not receiving grosser pollutions, and they indicate incompleteness of purification. In general the nitrates show the usual seasonal variation, but the higher figures of the late fall are wanting as cold rains had not yet commenced. Nitrates were quite in evidence in the spring but decreased in the late summer and early fall to a minimum period. Why the nitrates in the June and November samples were high at Dayton and low at Greenville, with the reverse condition in May is not quite understood.

Chlorine. Plate 17. The full extent of Greenville's influence upon the waters of Greenville Creek is shown better in the curves for chlorine than in the free ammonia of other curves. Two causes lead to this. First, chlorides are almost wanting in the water above the village under ordinary circumstances while considerable free ammonia is present with vegetative

organic matter. Second, the indirect influence from Greenville either by seepage or by direct surface drainage would contain its proportion of chlorine unchanged, while the organic matter by filtration and oxidation would have passed beyond the first steps of decay. After the rise at Greenville the chlorine curves show distinct drops due to dilution, except for October. Here it should be noted that the Greenville samples for the month named were affected by rainfall and the chlorides accordingly lowered, while the Dayton October sample was not so affected, and in addition it, for some reason not apparent, yielded the highest chlorine finding of the season for that station. Although the chlorine curve for August shows the usual upward tendency at Greenville yet attention is called to the high results then obtained at the upper station for chlorine, oxygen required, albuminoid and free ammonias. The dissolved oxygen in that sample was also high. This pollution occurring but the one time does not disclose to us its source.

The mineral characters of these waters are well shown by the findings for *alkalinity*, *incrusting constituents*, and *total solids*, (Plates 18-20), in addition to the sections just given. Due to the absence in these samples of the marked quantities of clay and silt obtained in most of the preceding investigation, the curves for solids agree better with those for alkalinity and incrusting constituents. In addition to carrying only small amounts of suspended matter, the Stillwater samples were noticeable for their lack of sulphates—being nearly as low in incrusting material as the water of the Little Miami River. The Stillwater samples, however, were not lacking in carbonates or bi-carbonates, as shown by the high alkalinities. The discrepancy in the direction of the April and October curves for solids compared with the actual mineral character of the waters was due to the local rains at those times at Dayton and Greenville, as already referred to.

In general the mineral character and total solids of the stream increase slightly at Greenville and then decrease much more by dilution with softer waters before Dayton is reached.

Bacteria. Plate 22. It is to be noted that none of the samples from Greenville Creek or Stillwater River were low in bacterial life for the best finding was at Dayton in May when 1000 bacteria were present in a cubic centimeter of the water and two-thirds of the samples taken had 2,000 or more bacteria per c. c. The indications are that the October result at Dayton was due to an accidental contamination, and it should not be taken as representative. The April findings at the two lower stations were augmented by the sharp rainfall at or before the time of collection. The slight downward course of the October curve at Greenville has no significance, since the bacterial content of both samples had been so far removed from normal by rain influences as to lose whatever value they might otherwise have possessed as indicators of sewage. The remaining curves by their course at Greenville show the increase in bacteria resulting

from the direct and indirect pollutions of the creek between the stations above and below Greenville.

SUMMARY FOR STILLWATER RIVER.

When uninfluenced by rains the water of this tributary is quite uniform in character, and when influenced by rains there is not the extreme variation that frequently appears elsewhere. This stream is moderately rich in vegetative matter but lower than some. Its quality is not such as would make it an acceptable source for a public supply if the raw water was used. Although the present Greenville water supply has some undesirable mineral characters, yet it is decidedly preferable to the raw water of Greenville Creek from a sanitary view.

Although the water above Dayton is on the whole somewhat better than that found above Greenville, yet the results indicate that purification is rather tardy and it may be found necessary for the sewage of Greenville to be treated before it is emptied into the river.

The average composition of the water as found in Greenville Creek and Stillwater River is as follows, the October bacterial finding at Dayton having been omitted as an unreliable one.

Color .....	.25	Chlorine	1.4
Turbidity .....	.17	Alkalinity	239.8
Oxygen required	4.79	Incrusting constituents	23.7
N. as albuminoid ammonia...	.245	Total solids	427.
N. as free ammonia.....	.068	Loss on ignition.....	140.
N. as nitrites.....	.016	Dissolved oxygen	8.96
N. as nitrates.....	1.42	Bacteria per c. c.....	7727

b. MAD RIVER.

The graphical representations of these results appear in curve "B". In order to permit "B" and "C" to be placed on the same plate, ten miles were omitted from curve "B" between Springfield and Dayton. Six stations were established on this division of the Great Miami watershed. The uppermost station was above Urbana; the next one was below Urbana and nearly a mile below the mouth of Dugan Creek, which branch bears a little sanitary sewage from Urbana and a considerable amount of strawboard factory waste. The third station was on Mad River above Springfield and just above the mouth of Lagonda or Buck Creek, which stream carries most of the sewage from the city of Springfield. The station which appears third on the plates, owing to its greater distance from the mouth of the Great Miami River, is the one above Springfield on Buck Creek. The last named station was opposite the present pumping station of the Springfield water works and at the point where a pipe enters Buck Creek to serve as a supplementary source for the supply of Springfield. The fifth station was on Mad River below Springfield and in order to include the pollution from the factories near that city had to be located some distance below the mouth of Buck Creek. The sixth station was on Mad River at Dayton and opposite Harshmanville.

Physical Properties. The main tributary of Mad River, viz: Buck Creek, possesses better physical properties than many of the Ohio streams but it is by no means to be thought of as a perfect water in this respect. The most notable change in color in the water of Mad River occurs as the result of the addition of strawboard factory refuse at Urbana. Taking the average above Urbana as a standard for Mad River, there is found such an increased color below Urbana that the average color at each station on Mad River proper remains higher than the standard until Dayton is reached, in spite of successive dilution.

Like the samples from the Stillwater watershed, those from Mad River fail to show great increases in turbidity after rains, for omitting the station below Urbana where the turbidity was modified by the strawboard effluent, we find the greatest turbidity for the season was above Urbana in September when the reading was only .38. Besides failing to become very roilly, it seems the water of Mad River quickly recovers from a changed turbidity as shown by the low findings of the May samples—preceded a few days by one of the hardest rains falling on this part of the watershed during the time of our studies. On the other hand the results from the Mad River basin indicate waters that are seldom really clear under ordinary conditions, for of forty-eight samples only three (two on Buck Creek and one on Mad River above Urbana) were clear enough to enable the wire of the turbidity stick to be seen beyond a depth of fourteen inches. In the three exceptions the wire was visible at a depth of 20 inches, which in one case was the depth of the water. In spite of the moderately low turbidities it is to be noted that an unusually large number of the samples—more than half—showed a “considerable” sediment. This would indicate the suspended matter was of the nature of vegetation, loam and sand rather than clay in its finely divided state. None of the samples were odorless except two from Buck Creek, while many showed by the odor their vegetable character.

Oxygen Required and Albuminoid Ammonia. Plates 12 and 13. As indicators of sewage these determinations were of little value in Mad River owing to the disturbances caused by pollution of another nature, but as indicators of the pollution from the strawboard factory they take high rank. The marked jumps taken by these curves at Urbana suggest a strong influence but the other findings and the facts show that only a very small amount of sanitary sewage enters the river from Urbana. The fluctuations at Urbana are due to the presence of greater or less amounts of factory wastes. The April and July curves are flatter than the others, the former because of dilution from rainfall, the latter because of a diminished amount of the factory refuse.

The amount of carbonaceous organic matter in Mad River was greater below Springfield than above only in May. Two factors helped to produce this result. One is the entrance of the water of Buck Creek between the sampling points; the other is the presence of so much unde-

composed material from the Urbana pollution as to cause the water of Mad River above Springfield to still be high in albuminoid ammonia and oxygen required. When the pollution below Urbana rose, the findings at Springfield were also higher, showing too great a pollution for the stream to handle in that distance and regain its normal purity. By a comparison of the results above Urbana with those above Dayton it is seen that in a flow of some forty-five miles sufficient purification and dilution had occurred to counterbalance the pollutions of Urbana and Springfield as judged by the findings for oxygen required and albuminoid ammonia. In connection with this, reference may be made to the findings and the curves (Plate 21) for dissolved oxygen. The amount of free oxygen was of course lowest below Urbana because of the strawboard factory refuse, and did not regain its normal until the above Dayton sampling place was reached. The results above Springfield on Buck Creek show a higher proportion of free oxygen.

The *Nitrites* (Plate 15) mark the pollution at Urbana, the flattened curves for April, July and October, being partially due to rain influences, and in part especially in July to a lessened pollution at Urbana. The nitrites agree with the free ammonia, chlorine and bacteria in showing the addition of sanitary sewage at Springfield. In general the nitrite findings above Dayton were but a trifle higher than those in Buck Creek above Springfield, and in Mad River above Urbana, indicating a fairly good degree of purification by the time the water reached Dayton.

Nitrates. Plate 16. Little comment is necessary here. The results on Buck Creek were generally a little higher than elsewhere. The November result above Dayton is not attributable to surface washings and its cause is not apparent.

Free Ammonia and Chlorine. Plates 14 and 17. These may be discussed together since they are for this stream the best indicators of the extent of sewage pollution. The only free ammonia curve failing to rise after the addition of Springfield's sewage was the one in June, when the finding above town was one-third higher than in any other month. This high reading as well as the somewhat lower, though still high ones for July and September, did not come from fresh sewage. The chlorines do not follow the three ammonia determinations just mentioned nor again in August below Urbana, when the chlorine curve takes an anomalous turn upward. In the latter case the water was unusually rich in oxygen consuming power at the time and a possible source for the chlorine may have been the muriatic acid, used at times in the process of making strawboard. The chlorine falls slightly from Springfield to Dayton with the dilution which is small in that stretch of the stream's flow. The amount of free ammonia above Dayton was moderately low except under the influence of the April surface washings, and was as low as that above Springfield on Buck Creek, or

above Urbana on Mad River and shows a return to original conditions after the pollutions which exist on this stream and tributaries.

The *Incrusting Constituents* (Plate 19) are generally low, but what appears unusual is their increase on the addition of surface washings.

The *Alkalinities* (Plate 18) are very high throughout. Except in April, when the water was high as noted by the collector, there occurs a marked increase in alkalinity below Urbana which is lost, however, by the time the water reaches the Dayton station. The water of Buck Creek is slightly richer in sulphates and poorer in carbonates than is the main stream, but in connection with the sewage of Springfield it affects the mineral nature of Mad River very little.

Since the highest figure obtained for total solids was 535, it is observed that none of the results for solids were unusual.

Bacteria. Plate 22. These findings and resulting curves show well the bacterial effects of the two major pollutions of Mad River, viz: the strawboard effluent at Urbana and the Springfield sewage. At each of these cities the curve exhibits a decided rise every time. The greater inflection was at Urbana, but of course the latter would constitute the more serious menace to health owing to the opportunity for the presence of pathogenic bacteria. Furthermore the strawboard refuse produces the more marked and more persistent disturbance of the physical properties of the water, and the appearance of a water receiving strawboard refuse would prevent the ordinary person from using it as a beverage where a sewage polluted water might be unhesitatingly accepted by that person because its appearance was not bad and because it had a good taste.

In no month was the bacterial finding above Dayton as low as above Springfield on Buck Creek, and only in August, September and November did the findings at the former place remain lower than those obtained above Urbana. From the bacterial side the pollutions of the river are not compensated for by natural processes of purification. Here again we would note the persistingly high bacterial content of a river water which has received the refuse from a strawboard manufactory. The Buck Creek bacterial findings were not so bad for an open stream when used for water powers and commercial enterprises, but they are not wholly satisfactory for a water to be supplied for domestic purposes to a large and thriving city. Omitting the Buck Creek samples, the Mad River results were all high, as only five samples showed less than 2,000 bacteria per c. c., viz., 700 and 1,700 in May and June above Urbana, 1,400 in August above Springfield, and 1,500 and 1,700 in May and August above Dayton. The greatest disturbance by rain was in April at Urbana and at Dayton, but not at Springfield as the samples at the last named city were taken two days earlier, and thus previous to the rain which occurred during the sampling period. The

minimum, maximum, and average bacterial findings per c. c. are given below arranged according to the minimums:

Station and Stream.	Minimum.	Maximum.	Average.
Springfield, above, Buck Creek.....	325	1,200	738
Urbana, above, Mad River.....	700	12,000	4,000
Springfield, above, Mad River.....	1,400	30,000	9,575
Dayton, above, Mad River.....	1,500	30,900	6,750
Springfield, below, Mad River.....	5,900	115,100	30,625
Urbana, below, Mad River.....	6,800	803,000	160,750

SUMMARY FOR MAD RIVER.

The average composition of the water of this stream including Buck Creek as determined by forty-eight samples from six stations is as follows.

Color .....	.26	Chlorine	1.4
Turbidity .....	.20	Alkalinity	262.2
Oxygen required	a9.24	Incrusting constituents	14.1
N. as albuminoid ammonia...	b.280	Total solids	430.
N. as free ammonia.....	d.070	Loss on ignition.....	136.
N. as nitrites.....	e.027	Dissolved oxygen	8.36
N. as nitrates.....	.85	Bacteria per c. c.....	c35406

a Ninety-five per cent. higher than it would have been with the findings below Urbana omitted.

b Thirty-one per cent. higher than with findings below Urbana omitted.

c Two hundred and forty-two per cent. higher than with findings below Urbana omitted.*

d Sixty-nine per cent. higher than with findings below Springfield omitted.

e Eighty-six per cent. higher than with findings from below Springfield and below Urbana omitted.

An interesting study is found in the foregoing table and the reference to the increases which occurred over what the average would have been in certain cases with the omission of the results below Urbana (so modified by strawboard factory refuse) or those below Springfield (modified by sewage).

If it were not for the marked pollution at Urbana and Springfield the waters of Mad River would be fair waters as regards organic material. The studies indicate in this stream a greater ability for self purification than in some cases. The water at Dayton compares favorably in most respects except as to the number of bacteria with the headwaters. The physical properties are included within moderate limits except for the addition of material from Dugan Creek at Urbana. Unlike some waters studied the present one will on a short sedimentation deposit most of its suspended matter although some fine material will remain in suspension for a considerable time. The best water of this system as far as our investigations were carried was found in Buck Creek, but

as indicated in various places in preceding tables, curves, and discussion, the water of Buck Creek does not possess a sufficiently high degree of purity to make it a wholly acceptable source of supply in the raw state for the city of Springfield.

C. GREAT MIAMI RIVER.

Thirteen stations are located on the Great Miami River proper, one station above and another below each of the following six cities: Sidney, Piqua, Troy, Dayton, Middletown and Hamilton, while the thirteenth station was below Cleves. The April sample at the last named place was taken below the mouth of Whitewater River, but the remaining collections were made above the point where that tributary empties. For further details as to location of sampling points the reader is referred to a previous section of this report. Attention is again called to the fact that it was necessary for the collector to make two trips owing to the number of stations, and consequently the samples at Middletown, Hamilton and Cleves were collected from five to fourteen days later in the month than those at Dayton and points farther north. During the following discussion the stations or samples referred to as *southern* are those at Cleves, Hamilton, and Middletown; while those at Dayton, Troy, Piqua and Sidney are spoken of as *northern* stations or northern samples.

Physical Properties. The color of the water was moderate in amount and fairly uniform throughout the stream and season. The highest average was .29 obtained below Middletown.

At most of the stations the prevailing odor was vegetative or at times earthy, but below the larger places, as Hamilton, Middletown, Dayton, Troy and Piqua the odor was stronger and less pleasing. In regard to the amounts of suspended matter considerable difference is noted between the northern and southern samples, because the former were influenced but little by rainfall except at Piqua in April, while the samples from the southern section usually gave evidence of present or recent rains. The April sampling period for the northern route was one of general rains, but Piqua being the last city visited on the trip showed the greatest influence from surface washings. In consequence of the presence of heavy surface washings in the waters of the southern section some excessive turbidities were obtained. In none of the investigations previous to this year have such high readings been obtained, and that the total solids were not higher in the cases of these abnormal turbidities indicates the presence of a very fine clay, and not suspended material of a heavier nature.

Seventy per cent. of the southern samples had "considerable" or "much" sediment while the clearest sample had a turbidity of .09. In support of these roilly findings in the lower course of the Great Miami River we would make mention of a statement made to the collector by a resident of Cleves who said he had lived in Cleves seven years and

did not remember seeing the water of the stream what could really be called clear.

Oxygen Required. Plate 23. *Albuminoid Ammonia.* Plate 24. The most noticeable additions of carbonaceous and nitrogenous matter by surface washings are shown at Piqua in April, and in the lower course of the stream in May, July, and also to a lesser degree in June. The curves of averages for these determinations also show the disturbances just noted. The unexpected jump upward from Middletown to Hamilton in May, when the samples from the two cities were taken within the space of three hours deserves explanation. There had been a heavy local rainfall on Seven Mile Creek. Its waters enter the Great Miami above Hamilton and below Middletown. The July result at Cleves was also due to surface washings.

Some of the Piqua pollutions enter the canal and some water escapes at intervals from the canal to the river between Piqua and Troy. This helps keep up the various findings for organic matter above Troy. The general upward trend of the various curves at Middletown is not due alone to sanitary sewage for certain of the determinations for organic matter are greatly modified by the nature of the manufacturing sewage admitted. By reference to the report of the Engineer, it is seen that Middletown possesses a thriving paper mill industry.

The failure of the curves for the oxygen required and albuminoid ammonia to rise at Dayton with the addition of the sewage of that city is worthy of consideration. Between the two Dayton stations on the Great Miami River that stream receives the waters of its two largest tributaries, viz., Mad and Stillwater rivers. By reference to Table I. of the Engineer's report it is seen that the drainage areas of Mad and Stillwater rivers are respectively 645 and 653 square miles. No gagings are available to inform us of the relative volumes but with the drainage areas so nearly equal and with nearly the same monthly rainfall (except in September) it is permissible to assume the volumes of water in Mad River and Stillwater River at Dayton were approximately the same. With equal quantities of water in these tributaries the mean of their quantities would represent the character of the tributary water received at Dayton. Wolfe Creek may be considered one of the pollutions of Dayton. From the analytical tables the following figures are obtained:

	Oxygen Re- quired.	Albuminoid Ammonia.
Average for Mad River at Dayton.....	3.87	.194
Average for Stillwater River at Dayton.....	4.50	.251
Mean of Mad and Stillwater Rivers at Dayton.....	4.18	.222
Average for Great Miami River above Dayton.....	5.90	.307
Average for Great Miami River below Dayton.....	5.46	.309

The drainage area of the Great Miami River above Dayton is 1158 square miles and that of the two tributaries is 1298 square miles. The rainfalls were on the whole similar. Without Dayton influence the average oxygen requirement below Dayton should have been close to 5.00 parts per million without additional purification, but the finding was 5.46 parts. In the same way the albuminoid ammonia below town would have been in the neighborhood of .262, whereas .309 parts were found. Therefore while a glance at the plates would cause one to think there had been no organic matter added at Dayton, a closer study shows there was such an addition which agrees with the facts as given in the Engineer's report.

The causes for the increased findings at Troy in September and November are not apparent. If the greater amounts of water had entered the river from the canal containing so much organic material, the oxygen required would also have been higher.

Nitrogen as Free Ammonia. Plate 25. The generally flat course of the curves shows the absence of such concentrated pollutions as were found below certain cities on watersheds previously studied. The averages show more or less of an increase between the above town and below town stations for each village or city where samples were taken.

Because of the relatively low amount of free ammonia in the water of Great Miami River above Dayton compared with the albuminoid and with the oxygen required, and because of the greater effect upon the free ammonia findings when sewage is introduced, we find the free ammonia curves rising below Dayton in spite of the diluting effects of Mad and Stillwater rivers as mentioned in the preceding section.

In connection with the distinct additions of free ammonia factors at a town no larger than Troy in comparison with larger places on the stream, reference should be made to the figures given in the Engineer's Table of Sewerage. While Troy is not one of the largest places on the stream yet it takes second rank among those on the Great Miami in the estimated per cent. of population using sewers, and in actual number of persons using sewers, only two places on the main stream (Dayton and Hamilton) make a higher showing. In addition to this relatively heavy sanitary sewage pollution, we should not fail to mention the refuse which reaches the river from the slaughter houses at the edge of Troy. The unusual result at the place just named in April may have had some connection with the heavy rainfall at the time of taking those samples. Similar fluctuations for chlorine and nitrates appear but not for albuminoid ammonia and oxygen required.

In September at Hamilton the water was low and the below town finding was greater than at any other time in the season—causing a greater inflection in the curve.

Nitrogen as Nitrites and Nitrates. Plate 26 and 27. The nitrites, and to a lesser degree the nitrates, show the effect of urban pollutions.

Like the free ammonia the nitrites show more prominently than the oxygen requirement and the albuminoid ammonia the pollution from Dayton.

The April nitrates at Piqua are in evidence because of the effect of the rainfall influencing those samples so much more than the others as previously noted. The curve's jump at Dayton in November is not attributed alone to the Great Miami nor to Dayton as the samples at Dayton on Mad River and Stillwater River were also high.

Chlorine. Plate 28. As indicators of urban pollution these findings need little comment—the curves speak for themselves as they show the addition of sewage at each town and city. The chlorine curves at Dayton are not misleading as were those from some of the other determinations since the chlorine was less influenced by other causes. April yielded the flattest curve for the samples were all under some rainfall influence. In September the southern samples were taken under drier conditions and the lack of dilution is apparent in the higher level of that portion of the September curve. The drops from below Middletown to above Hamilton in May and July are not customary and they were occasioned by the decidedly greater amounts of rainwater at the latter place. This influx of rainwater was chiefly from Seven Mile Creek where heavy rains had occurred. The extent of these peculiar rain changes may be illustrated by a comparison of turbidities although the Hamilton sample was taken within two hours of the one below Middletown. In May the turbidity below Middletown was .16 and above Hamilton 5.60; in July the turbidity below Middletown was .54 and above Hamilton 2.45. The determinations for oxygen required and albuminoid ammonia also show the same changes.

Alkalinity and Incrusting Constituents. Plates 29 and 30. As shown by the findings and the curves for averages the waters of this stream were fairly uniform in these characters. The carbonates were very high but the sulphates and chlorides were low and thus while the water at any place is hard yet the hardness is chiefly temporary and thus better than in some of the streams of Ohio. Two breaks are noticeable on the alkalinity plate due to rain influences in April and May.

Total Solids. Plate 31. Agreeing in general with the combined alkalinity and incrusting constituents the solids showed no marked departure from the normal except when heavy rains caused the waters to contain larger proportions of soil as at Piqua in April, at Hamilton in May, and at Cleves in May and July.

Dissolved Oxygen. Plate 32. These findings were not fully satisfactory, the course of the curves at Troy not being in accord with the other findings and as yet not understood. The paper mill effect is noticeable at Middletown, while the results at Sidney were increased by the oxygen given off by growing algae and other vegetation.

Bacteria. Plate 33. The bacterial findings do not stand out so prominently in their indications here as in most of the previous studies, but nevertheless they afford much information. The curve of averages shows an upward inflection at each city or town, and but three exceptions are noted in the monthly curves. At Hamilton in May the above town sample was so greatly increased in number of bacteria from the water of Seven Mile Creek, which had just entered the main stream, that there was a falling off in numbers by the time the curve reached the below town station. At Troy in April the rain during the night previous to the collection of the samples had washed in an abundant supply of organic matter above town, as shown by the highest findings there obtained for the season in free ammonia, nitrites and bacteria. In August at the same station other organic findings were high as well as the bacteria.

The generally high results for April, especially in the northern section, show rain influences with the climax at Piqua. From the averages it would appear that the southern portion of the river was the richer in bacterial life, but it must be remembered in this connection that while the northern samples received a general rain in April, they were but little disturbed at other times, while several of the southern samples received more or less serious additions of surface water and the bacterial fluctuations appear which follow such additions. While sufficient data is lacking for a positive statement, it would seem from certain indications that under similar conditions of weather, the water of the lower portion of the Great Miami River would not be higher in bacteria than the upper portion if as high.

It is to be noticed that the curves do not fall between Sidney and Piqua, and further reference to other plates and to the table shows that the same holds true in general for other determinations. This would indicate the entrance of some pollution between the stations below Sidney and above Piqua.

As shown earlier in the discussion the introduction of the tributary waters from Mad and Stillwater rivers at Dayton, caused some of the findings to indicate in a lessened manner the pollution from Dayton. In contradistinction to these, we would call attention to the unmistakable indications obtained by the Dayton bacterial studies.

The bacteriological findings indicate that after the pollution from Sidney the water fails to again attain a bacterial character as low as it had above Sidney. Only three of the eight samples at the station last named contained over 1000 per c. c., while none of the 96 samples from the other stations contained as low as 1000 bacteria per c. c., the nearest approach being 1100 above Hamilton in September. Taking the average number of bacteria found in eight samples above Sidney we have 1900 bacteria per c. c., and only four out of 96 samples from subsequent stations contain as few as that high number, showing that the water of the Great

Miami is much lower in microbic life above Sidney than at subsequent places in its course.

It would have been desirable to have included, as a part of the regular work, the search for intestinal organisms, but stress of work prevented this procedure except in August, September and a portion of October.

The following table gives the rank of each station by minimum, and then by average findings; the minimum, maximum, and average number of bacteria found. In the last two columns are given the number of months in which the samples were examined for intestinal bacteria and the number of months when colon bacilli were found in that search.

Station.	Minimum rank.	Average rank.	Minimum.	Maximum.	Average.	Samples tested for colon bacilli.	Samples found to contain colon bacilli.
Sidney, above	1	1	450	6,600	1,906	3	0
Hamilton, above	2	9	1,100	84,500	25,350	2	2
Piqua, above	3	*6	1,400	*57,000	*11,075	3	1
Sidney, below	4	2	1,600	10,800	4,750	3	3
Cleves, below	5	5	2,300	17,200	7,038	2	1
Middletown, above	6	7	2,400	54,900	18,888	2	1
Dayton, above	7	3	2,700	17,600	5,600	3	1
Troy, above	8	4	2,800	10,600	5,625	3	2
Middletown, below	9	11	2,800	124,100	42,987	2	2
Hamilton, below	10	10	3,200	78,600	33,400	2	2
Troy, below	11	12	4,000	228,000	51,562	3	3
Dayton, below	12	13	8,100	150,000	65,487	3	3
Piqua, below	13	8	8,900	61,700	22,638	3	3

SUMMARY FOR GREAT MIAMI RIVER.

The summaries for the tributaries Mad and Stillwater rivers have already been given and the following refers only to the Great Miami proper.

Taking the average of the findings of the 104 samples we have the following as the average composition of the Great Miami River:

Color .....	.26	Chlorine	3.
Turbidity .....	.60	Alkalinity	211.6
Oxygen required	7.40	Incrusting constituents	22.1
N. as albuminoid ammonia...	.339	Total solids	475.
N. as free ammonia.....	.070	Loss by ignition.....	135.
N. as nitrites.....	.016	Dissolved oxygen	8.38
N. as nitrates.....	.72	Bacteria per c. c.....	22793

* Omitting the April finding above Piqua, which was an unusual one, the maximum number at that station falls to 8,000, the average to 4,514, and the station receives second rank by averages instead of sixth.

The above is a high turbidity for an average and is somewhat unduly increased by a few excessive findings, but it is true that the water of the Great Miami carries at time of heavy rain a large amount of suspended matter and that it retains for a considerable period a portion of finely divided clay so that clear waters are rarely found in its course. Seven Mile Creek with its clay territory and rather steep flow is one of the greatest producers of roilly water in the state.

The Great Miami River water is hard. The scale-forming element is not so large but its carbonates and bi-carbonates exceed those of any of the streams previously studied. The Olentangy and the Scioto are but little lower in alkalinity but they are much higher in incrusting constituents, than the Great Miami. As hard as is the main stream it is a trifle softer than its two largest tributaries in Ohio. Like some other streams in the state this one contains a large amount of vegetative organic matter. When there is added to this normally high organic content, the various amounts of sanitary and factory sewage which enter at the several larger centers of population there results an undesirable condition of pollution for the water has difficulty in purifying itself by natural processes. It is not to be wondered at that the number of bacteria is so high — an average of nearly 23,000 per c. c. (This figure is slightly increased if the findings on Mad and Stillwater rivers be included). With the water now struggling to regain its normal condition, what will it be a few years hence with the increased pollutions that will come from the growing cities situated on the banks of the Great Miami and its tributaries? It will be only a short time until this stream will need to be protected from the introduction of untreated sewages. At present it does not anywhere show the foul conditions which unfortunately exist on some other streams, but it does receive one pollution after another, with such frequency as to cause the quality of the water at all times to be under suspicion. The water above Sidney cannot be called suitable for a public supply, and while it may have improved in one or two respects at any given place further down the stream, yet on the whole it is even less potable, and therefore it can be said there is no place in its course that the water of the Great Miami River should in its present condition be considered as fit for a public water supply.

REPORT UPON A SANITARY SURVEY OF THE WATERSHEDS OF THE GREAT MIAMI AND LITTLE MIAMI RIVERS.

By BENJ. H. FLYNN,

ENGINEER TO THE OHIO STATE BOARD OF HEALTH.

SYNOPSIS.

- I. INTRODUCTION.
- II. GENERAL DESCRIPTION OF WATERSHEDS.
- III. POPULATION OF WATERSHEDS.
- IV. POLLUTION OF WATERSHEDS.
 - A. SOURCES OF POLLUTION.
 - B. AMOUNT OF POLLUTION.
- V. ICE SUPPLIES.
- VI. PUBLIC WATER SUPPLIES.
- VII. DAMS AND WATER POWER.
- AA. STREAM GAGING.

I. INTRODUCTION.

The watershed work for the season of 1900 covered the entire drainage of the Little Miami River and such part of the Great Miami River basin as lies above the junction of the Whitewater River and the above stream. This includes for the Great Miami watershed practically all of the drainage area lying within the state of Ohio and also two small sections just across the Indiana line. The small strip of land below the confluence of the Whitewater and the Great Miami and all the watershed of the former stream, practically all of which is in Indiana, were not touched in this work.

From the nature of the study which is being made by the Board it would be useless to investigate any territory outside of the state or the small stretch of land below the entrance of a large, what may be called, foreign stream into the river under investigation.

The intention has been to keep the scope of the work for the past year, in agreement with that of the previous years, and it is believed that it has been accomplished, though with a little less personal investigation. The methods in use have been more on a parallel with those in use during the latter part of the season of 1899. Before the field work was started in the spring, blanks requesting information as to population, drainage, and neighboring industries were sent to all health officers and township clerks in the area under investigation. These were filled out in a much better manner than usual and a large amount of general information was thus gathered at very slight expense. With the knowledge thus secured the field work could be laid out with a great saving of time and expense in useless trips to small villages containing nothing but a few houses and stores.

As in the previous years all the larger towns were visited and personal investigations made of their water supply and sewerage. These investigations included also all the isolated public and private institutions of any size.

Information was also gathered concerning the general character of the industrial wastes, with special reference to those which affect the purity of the streams into which they are dumped or to which they drain.

Along with the sanitary survey of the watershed as complete information as possible was secured concerning the dams and water-powers. It is hoped that the data on these subjects will be of use in estimating the runoff of the various streams and in accounting for the variation of their flow.

The investigation of the ice supplies was limited as in the previous year, to a mere outline of the sources from which the bulk of the supply is obtained.

II. GENERAL DESCRIPTION OF WATERSHEDS.

The Miami watersheds occupy a large portion of the southwestern part of Ohio and a considerable area in the south-eastern part of Indiana. The Little Miami watershed lies to the east and south of the Great Miami watershed and to the west of the Scioto River basin. The waters from its southern border are carried by short turbulent creeks direct to the Ohio River.

The Great Miami watershed is much larger than that of the Little Miami and extends on the north to the area drained by the extreme northern tributaries of the Scioto and Wabash rivers and the southern tributaries of the Maumee. The western part of this basin, in Indiana, borders on territory tributary to White River, a branch of the Wabash.

The western tributary of the Great Miami River, the Whitewater River, enters it only five miles from the confluence of the former with the Ohio, and for the purposes of this investigation it was separated from the Great Miami River, as nearly all of its drainage area lies within Indiana.

The Great and Little Miami rivers occupy rather narrow valleys, with the general axis of each lying east of north.

It will be noted that the main drainage lines of the Great and Little Miami watersheds occupy respectively the eastern and western portions of the drainage areas so that the Great and Little Miami rivers are brought quite close together, with the principal tributaries joining them from the opposite sides. The one exception to this is Mad River which enters the Great Miami at Dayton from the east. The lower portion of these two watersheds are separated by a small area tributary to Mill Creek and to the Ohio River direct.

The Miami watersheds include all of Miami, Montgomery, and Warren counties, the major portion of Butler, Champaign, Clark, Clermont, Clinton, Darke, Green, Logan, Preble, and Shelby counties, and small portions of Auglaize, Brown, Fayette, Hamilton, Hardin, Highland, Madison, and Mercer, also of Franklin, Randolph, Union, and Wayne counties, Indiana. The above description only takes in the portion of the Great Miami watershed that is above the Whitewater River.

AREA.

The total area of the Great Miami watershed is 5247 square miles, of which 1355 square miles are in Indiana and the remaining 3892 in Ohio.

The total area of the Little Miami watershed is 1709 square miles, all of which is in Ohio.

The total for the two watersheds is 6956, of which 5601 square miles are in Ohio. The area above the confluence of the Whitewater River

and the Great Miami is 3809 square miles, of which 81 are in Indiana. This last named area of 3809 square miles gives the extent of the territory which it was intended to cover in this survey, making the total area covered, with the Little Miami, 5518 square miles, something over 1000 square miles less than was gone over the previous year.

These areas were determined by careful planimeter measurements from the State Board of Health watershed map of Ohio and from the General Land Office map of Indiana. The Ohio areas are probably more accurate than those in Indiana, but they all agree fairly well with the results of other investigations.

For convenience in studying it, the Great Miami watershed has been divided into four subsidiary watersheds, namely: Stillwater, Mad, Upper Great Miami, and Lower Great Miami. The first two names are self-explanatory, the third name is applied to all the territory above Dayton and between Mad and Stillwater rivers, and the fourth includes all the territory below Dayton and the Mad and Stillwater basins. The Little Miami watershed was not subdivided.

The areas of these subsidiary watersheds together with many of the still smaller streams are given in the following table:

TABLE I—AREAS OF WATERSHEDS.

Watershed.	Area in Square Miles.
Stillwater River	653
Greenville Creek	200
Upper Great Miami.....	1,158
Lorannie Creek	244
Mad River	645
Buck Creek	160
Lower Great Miami (above Whitewater).....	1,353
Indian Creek	129
Seven-Mile Creek	282
Twin Creek	321
Total for Great Miami River (above Whitewater).....	3,809
Great Miami River below and including Whitewater.....	1,438
Total for Great Miami River.....	5,247
Little Miami River.....	1,709
Cæsar's Creek	237
Todd's Fork	241
East Branch Little Miami River.....	475
Total for Little Miami River and Great Miami River (above Whitewater).....	5,518
Grand total for Miami Rivers.....	6,956

GENERAL TOPOGRAPHY.

As a general statement the Miami watersheds, with reference to the surface formations, occupy a place in between the Maumee and Sandusky basins on one hand and the Muskingum on the other. In the district under discussion there are found greater extremes of elevation than in any other portion of the state, but the slopes are more uniform, the surface more rolling, than is found in the Muskingum watershed and there is none of the level prairie formation that is found in the north-western part of Ohio.

A dictionary of altitudes published by the U. S. Geological Survey gives the mean low water level in the Ohio River at the confluence of the Great Miami as 425 feet above sea level and the elevation of a point east of Bellefontaine as 1540 feet, these are the extreme elevations of the State.

The north-western part of the Great Miami basin and the north-eastern part of the Little Miami consist of comparatively level elevated areas, marked, however, with rolling glacial moraines. Between these two districts and connecting the extremes of elevation mentioned above there is a wide strip of quite hilly and heavily rolling land with a rather steep slope to the south-west. A narrow strip of high land running lengthwise of this area forms the dividing line between the Great and Little Miami basins.

As the entire area of both watersheds has been glaciated the surface presents the smoothed-over appearance which accompanies this phenomenon and no abrupt changes are to be found except where the streams have cut out their valleys in the soft drift.

The surface is covered with wide areas of a heavy limestone soil crossed with narrow stretches of a loamy and gravelly soil. Some of the stream valleys contain extensive alluvial deposits, forming very fertile areas for cultivation. Much of the clay sub-soil of the southern part of the Little Miami watershed is covered with loam, forming on the level uplands excellent farming districts.

As the whole district is essentially an agricultural one the timber was rapidly cleared off and but small isolated wood lots now remain over the tillable portion. Along the steep hillsides and the streams there are still found stretches of forest, much of which is scrub or young growth, all the merchantable timber having been cut out.

The lower and rougher portions of the Little Miami watershed contain the most heavily wooded areas to be found in either basin. Here on the steep hills bordering the streams there are still to be found many good tracts of timber, the inaccessibility of which has so far prevented their destruction.

Corn, wheat and tobacco are the staple crops, the last being important in both districts. On account of the proximity of the large urban

population in and around Cincinnati, quite extensive dairy interests have been built up.

Good roads cover nearly all of both watersheds, indicating better than anything else that they are rich districts inhabited by a prosperous and enlightened people.

GEOLOGY.

As stated both areas have come under the influence of the glacial action which has covered the original strata with a layer of drift from 5 to more than 100 feet thick.

Practically all the bed rock belongs to the Silurian age, with the Hudson River group, the Utica shale, and the Trenton limestone covering the entire southern portion of both watersheds, while to the north and east there is a wide band of the Niagara, Clinton, and Medina group, and to the extreme northeast is found the lower Helderberg and Waterlime group.

On the high elevation east of Bellefontaine there appear small areas of both groups of the Devonian age; the Hamilton and Upper Helderberg and the shales.

Near Dayton and in the valleys of the Stillwater at Covington and of the Mad River below Springfield there are quite extensive limestone quarries. At the latter place and at Cedarville on Massicks Creek a considerable quantity of limestone is taken out to be roasted for lime.

DRAINAGE.

The main drainage line, the Great Miami River, of the Great Miami watershed starts at the extreme north-eastern part of the district and runs in a south-westerly direction, joining the Ohio River at the Ohio and Indiana state line. Until Dayton is reached it occupies the central portion of the watershed but from that point on it lies very close to the eastern edge of its drainage area. Below Dayton its tributaries, not considering the Whitewater River, consist of Indian, Seven Mile, and Twin creeks, each of which drains a long and narrow strip of territory. At Dayton the main stream receives two large tributaries; the Mad River from the east and Stillwater River from the west.

In the Little Miami watershed the main drainage line, the Little Miami River, rises in the extreme northern part of the district and flows south-west keeping close to the western boundary for its whole length and finally joining the Ohio a few miles above Cincinnati. Its principal tributaries, all coming in from the east, are the east branch of the Little Miami, Todd's Fork, Caesar's Creek, and Massick's Creek, the first named being the most important.

The length, total fall, and fall per mile of the main streams and tributaries of both watersheds are shown in the following table:

TABLE II—APPROXIMATE GRADIENT OF PRINCIPAL STREAMS.

Stream	From	To	Distance in Miles.	Total Fall in Feet.	Average Fall per Mile.
Great Miami River.....	Ohio River.....	Hamilton	33	145	4.4
" " ".....	Hamilton	Dayton	44	160	3.6
" " ".....	Dayton	Piqua	33	110	3.3
" " ".....	Piqua	Degraff	27	120	4.4
" " ".....	Degraff	Headwaters	26	90	3.5
" " ".....	Ohio River.....	"	163	625	3.8
Stillwater River.....	Dayton	Covington	30	150	5.0
" " ".....	Covington	Headwaters Green- ville Creek	36	240	6.7
" " ".....	"	Headwaters Still- water River	32	165	5.0
" " ".....	Dayton	Headwaters Green- ville Creek	66	390	5.9
" " ".....	"	Headwaters Still- water River	62	315	5.1
Mad River.....	"	Springfield	23	170	7.4
" " ".....	Springfield	Headwaters	35	300	8.6
" " ".....	Dayton	"	58	470	8.1
Twin Creek.....	Great Miami River	"	48	450	9.4
Seven-Mile Creek	"	"	34	510	15.0
Little Miami River.....	Ohio River.....	Milford	13	66	5.1
" " ".....	Milford	Waynesville	35	180	5.1
" " ".....	Waynesville	Headwaters	46	450	9.8
" " ".....	Ohio River.....	"	94	696	7.4
E. Branch L. Miami R..	Little Miami River	Batavia	12	105	8.8
" " ".....	Batavia	Williamsburg	19	200	10.5
" " ".....	Williamsburg	Headwaters	42	300	7.1
" " ".....	Little Miami River	"	73	605	8.2

It is evident at once from this table that all the streams of the watershed have very rapid rates of flow. Even the lowest average gradient, 3.3 feet per mile as found between Dayton and Piqua, is sufficient in a large stream to give a very good current. The Great Miami River has throughout its entire course a very uniform gradient, more so than is usually found in such a long stream. Mad River also has a quite uniform but a much steeper gradient. As would be expected the streams, Seven Mile and Twin creeks, coming down from the high land near the Indiana line have a very high gradient, the highest to be found in both watersheds. The upper part of the Little Miami River and the east branch of the same stream also have high rates of flow induced by steep gradients. At one time advantage was taken of these excellent streams by numerous water powers but now many of these have been abandoned. This question will be taken up later in connection with the descriptions of the water power still in use.

Owing to the extensive use of the land for agricultural purposes there are no extensive tracts of swamp land left. Many large areas

have been ditched and tilled turning what was formerly waste land into exceptionally fertile fields.

The valley of the Mad River between Dayton and Springfield, except immediately below the latter city, is very low and swampy, much of it being so low that it can with but great difficulty be drained for use. Along this same stream, in Champaign County, there are large areas of low, wet, peaty land which has as yet not been successfully drained.

III. POPULATION.

For the first time since the beginning of this work has it been possible to make a satisfactory study of the population on the watersheds under investigation. For this year the reports of the 1900 Census are available, and as accurate data as it is possible to secure in this country could be had for the work.

The figures for urban population are accurate except where a city is on the dividing line of the watershed, when it was necessary to estimate the population within the watershed. This occurred only in three cases; Cincinnati, Evanston, and Hyde Park, portions of each of which are in the Little Miami drainage area.

The same figure, 1000, has been assumed for the dividing line between urban and rural when classifying the villages, though in these districts a larger one could be better used than in any of the former cases on account of the large number of villages with populations above this figure and still unprovided with public improvements. It is true also that any material raising of the standard would throw into the rural population many villages which have public water supplies and more or less sewerage.

In determining the rural population, the population of every village it was possible to obtain was subtracted from the total township population and the remainder assigned to the proper watershed according to the area each contained, then the village populations were assigned to their proper districts.

Using these methods the total population of the entire Great Miami watershed in Ohio and Indiana was 520,698 of which 258,859 was classed as urban and 261,839 as rural. Of the total population 89,814 was in Indiana, divided as follows: urban 32,062 and rural 57,752.

For the Great Miami watershed above Whitewater, as used in this report, the total population was 430,884 of which 226,797 was urban and 204,087 was rural. Of this rural population 3647 was in Indiana; there was no urban population in Indiana within the watershed proper.

The total population of the Little Miami watershed was 120,959 of which 39,645 was urban and 81,314 rural.

These same figures for the subsidiary watersheds, for both watersheds and for the state, also the population of each class per square mile are given in the following table.

TABLE III — POPULATION ON WATERSHEDS.

Watershed.	Total Population.			Population per Square Mile.		
	Urban.	Rural.	Total.	Urban.	Rural.	Total.
Stillwater	11,249	39,921	51,170	17.2	61.1	78.3
Upper Great Miami.....	34,708	56,027	90,735	30.0	48.4	78.4
Mad River	47,519	29,785	77,304	73.7	46.2	119.9
Lower Great Miami....	133,321	78,354	211,675	98.5	57.9	156.4
Total for Great Miami	226,797	204,087	430,884	59.5	53.6	113.1
Little Miami	39,645	81,314	120,959	23.2	47.6	70.8
Total for Miamis.....	266,442	285,401	551,843	48.3	51.7	100.0
The State	2,202,857	1,954,688	4,157,545	54.0	48.0	102.0

This table shows that for the Great Miami watershed both the urban and the rural population are in excess of the average for the state while in the Little Miami watershed the urban population is less than one-half of the average and the rural is the same as the average rural for the state. For both watersheds the average urban population is 6 per square mile less and the rural 4 per square mile in excess of the averages for the state, making the total average only two less than the total for the state, 102 per square mile.

Contrary to expectations both the Stillwater and Upper Great Miami watersheds have an average population per square mile but little in excess of that for the Little Miami watershed with its large area of rough hilly country. Dayton and Springfield are responsible for the large urban population in the Lower Great Miami and the Mad River districts, respectively.

It will be interesting to note that in the small area, 216 square miles, between the Miami Rivers, and tributary to Mill Creek and to the Ohio River district, there is a total population of 375,571 of which 350,894 is urban and 24,677 rural. This gives an average population per square mile as follows: urban 1625, rural 114, and a total of 1739.

The sewage of a good per cent. of this enormous population together with millions of gallons of objectionable industrial wastes finds its way to Mill Creek, turning the latter into an exceedingly foul open sewer.

IV. POLLUTION OF WATERSHED.

A. SOURCES OF POLLUTION.

The factors to which the pollution of the watersheds is due are, as formerly stated, farm drainage, sewage of towns and institutions, the drainage from dumps, and industrial wastes. As this subject was fully discussed in the report on the pollution of the Muskingum watershed in the 1899 annual report, it is not considered necessary to go into details here.

It will suffice to say that farm drainage is meant to include all the wastes from the rural population and from that portion of the urban population that is not within reach of sewers. In this class there should be placed the pollution caused by the excrementitious matter of domestic animals which is found spread over fields as manure, heaped up in barn-yards and pig pens, and scattered over streets and roads. Country slaughtering, surface privies, kitchen slops, etc., also add much to the pollution of the small streams draining rural communities.

The most serious pollution of the streams of course is to be found in the sending of sewage of towns and public institutions direct to them for disposal. The storm water sewers, of a thickly settled community, carry in concentrated form, much of the objectionable refuse which is responsible for the so-called rural pollution.

Under the head of pollution caused by dumps is included the very offensive drainage from night soil and garbage dumps and tipping grounds and the less objectionable leechings from general refuse heaps. A no more foul and disgusting thing can be imagined than the dumping of night soil and dead animals into the streams or so near them that every rain or high water washes the stuff into the channel.

The industrial wastes of the Miami watersheds differ from those of the Muskingum district in the absence of coal mine drainage and the addition of a large amount of waste from paper mills. This latter is especially true of the Great Miami river which has on its borders a number of large paper mills which send their refuse direct to the streams. Briefly this waste consists of the filth, both organic and inorganic, washed and bleached from the stock from which paper is made, and of the chemicals used in this, and also the final process of mixing, coloring, etc. These consist of bleaching preparations, chlorine, and lime, the various acids separating the fiber, and cleaning machinery, and the dyes and filling material used in the final finishing.

With the exception of this one industry which is peculiar to this section the remainder of the manufacturing plants are such as are found throughout the state. These consist of breweries, cider mills, canning factories, distilleries, strawboard works, wood-working shops,

etc., the waste from which is in general vegetable; then creameries, cheese factories, slaughter houses, soap and rendering works, tanneries, woolen mills, etc., which send out animal refuse, and finally those turning out mineral waste, as gas works, metal-working shops, etc. It may be stated that the easily decaying vegetable, all the animal, and a few of the mineral wastes cause a nuisance, while practically all the industrial wastes if present in quantity destroy the potability of a water.

As a general rule it is probably true that as soon as a water polluted by industrial wastes recovers its physical purity, so to speak, it has recovered its potability, while a sewage polluted water cannot be considered within reasonable limits as ever again becoming potable. In some cases an industrial waste may supply the food necessary for the maintenance of harmful bacteria in a water and in this way destroy the usefulness of stream as a source of water supply.

B. AMOUNT OF POLLUTION.

Under this head there will be given a brief description of the larger towns, with their industries, sewerage, etc., and any special source of pollution. For the smaller places, the combined population, industries, etc., on each small tributary, will be given so as to make it possible to form some idea of the character of the water to be expected in these streams. These small tributaries will be taken up in order, beginning at the mouths of the Great and Little Miami rivers respectively, and bringing in each stream in its turn.

Details of the sewerage systems and water supplies of both towns and institutions will be given in special sections following the one in question.

1. LOCATION AND AMOUNT OF ALL THE ABOVE MENTIONED SOURCES OF POLLUTION.

a. GREAT MIAMI RIVER.

Taylor's Creek. This stream drains the very hilly portion of Hamilton county just west of Cincinnati, on which are the small villages of Sheartown and Dent. The combined population of these is some 300 and neither has any industries.

Miamitown. Population 400. Here there is located a small saw mill and cider press.

New Baltimore. Population 125. In the Great Miami River opposite this place is a small dam supplying water-power to a combined saw and flour mill.

Ross. Population 300. This village supports a flour mill and two saw mills.

Indian Creek. On this long and narrow watershed there are the villages of Millville, Woods, Reiley, Mixerville, College Corner, Cottage Grove, Goodwin's Corner, and Beechmire, the latter ones being in Indiana. The combined population of these villages does not exceed 1400 with 500 for the largest, College Corner. There is still some lumber left in this section and nearly every village has one or more saw mills.

Symmes Corner. Population 135. * This village is on a small creek which enters the river a few miles below Hamilton.

Hamilton. Population 23,914. This city, the county seat of Butler County, is drained by the Great Miami River, passing through its center, and the Miami and Erie canal through its eastern portion. It has a good water supply and quite an extensive system of both sanitary and storm sewers. It is estimated that the sewage of 4700 people is sent to the river direct. The large per cent. of the population not accessible to the sewers, use walled up vaults, very few of which are water-tight. These must be cleaned out and the night soil is hauled to the country, a little being dumped into the river however. Kitchen garbage and refuse in general is tipped on low land near the river where it is finally washed into the latter by high water. There are supported here a large and varied assortment of industries, among which are two large paper mills, two safe and lock factories, several large foundries and machine shops, agricultural implement works, shoe factory, a number of important wood working shops, malting house, brewery, flour mills, carriage factory, gas works, etc. Many of these concerns are furnished power from the Hamilton hydraulic which obtains its water from the Great Miami River some five miles above the city. The public water supply is of good quality and is in general use. Those not using the same must depend on wells, most of which are driven from 20 to 60 feet into a bed of sand and gravel.

Butler County Infirmary. Population 152. The sewage from this whole institution is emptied into an open pit which drains through a small run, direct to the Great Miami River.

Seven Mile Creek. This, one of the large tributaries of the Great Miami, joins the latter only a few miles above Hamilton. A short distance above its mouth the stream branches, with Four Mile Creek turning off to the west.

Four Mile Creek. On this watershed in addition to Oxford there are the villages of Darrrtown, Morning Sun, Fair Haven, West Florence, and Campbellstown. The combined population is 550 and the industries consist of a few scattered saw mills.

Oxford. Population 2009. This village has a public water supply but no sewers outside of those found in the four institutions located in and near it. Several house drains lead out on the fields from which some of the sewage is washed to the creek. The village is an educa-

tional center with its industries limited to a saw mill, flour mill, and planing mill. Those not using the village water obtain their supply from wells dug 15 to 20 feet into hardpan, gravel and rock. In the Miami University, Oxford College, The Western and Oxford Retreat there are something over 500 people. Each of these institutions is furnished with a water supply under pressure and with sewered closets, the waste from which reaches the creek by more or less direct routes.

Seven Mile Creek. On the main branch of the stream there are, in addition to Eaton, the villages of Seven Mile, Collinsville, Somerville, Camden, and Upshur. In all these have a population of 1770, of which 905 belong to Camden, the largest of the group. The industries of these villages consist of the usual saw and planing mills for each, with the addition of a creamery and flour mill in Camden.

Eaton. Population 3155. This village, the county seat of Preble county, has a good public water supply but no sewers beyond a few short storm drains. Vaults are constructed in any and every way and but few are ever cleaned out, many being covered over when full. Garbage and night soil are hauled to the country and there disposed of.

The industries consist of a canning factory, flour mill, two saw mills, glove factory, furniture factory, tile mill, ice factory, etc.

The private water supply is of less importance each year as the village water is introduced. The wells in use are dug from 12 to 40 feet deep into gravel and rock, the latter appearing in the western part of the village.

Preble County Children's Home. Population 54. As yet this institution sends no sewage to the creek but extensive improvements are being made and very soon both inmates and officers will have the use of sewered closets.

Preble County Infirmary. Population 55. The infirmary is provided with sewered closets which are used by some twenty people, the remainder using outdoor vaults. The sewage is sent to a small cesspool or pit which holds back much solid matter but allows the liquid portion to pass direct to the creek.

Gregory Creek. Tributary to this small creek are the villages of Lesourdville, Monroe, Huntsville, Hughes, Bethany, Tylersville, and Mauds. The combined population is 690 and the industries consist of a flour mill, and a few small tile and saw mills.

Dick's Creek. The drainage of Amanda and Excello goes to this creek and to the Miami and Erie canal. These villages have populations of 210 and 120 respectively, and each supports a large paper mill.

Elk Creek. In the watershed of this creek are the villages of Trenton, Miltonville, Jacksonboro, Greenbush and West Elkton, whose combined population is nearly 900. The industries of these consist of two small saw mills and a buggy factory. At Trenton are located the car barns for one of the interurban electric roads.

Great Miami River.

Middletown. Population 9,215. This city occupies the east side of the Great Miami River, with a small suburb Heno, on the west bank. Middletown has an excellent water supply and a rather extensive system of combined sewers, which carries the sewage of some 2000 people direct to the Great Miami River. Those not accessible to the sewers use vaults which must be ten feet deep but are not required to be water-tight unless they are in the upper end of town near the water works well, in the neighborhood of which an attempt is being made to protect the sub-surface water. Night soil and garbage is dumped in and near the river just below the city. Dead animals are buried in the gravel near this point.

The waste from a large number of manufacturing establishments finds its way to the river also: a small amount however goes to the canal. Among the industries are five large paper mills, a large tobacco factory, tobacco warehouses, rolling mill, bicycle factory, machine shops, carriage works, brewery, malt house, slaughter houses, gas works, flour mill, saw mills, etc. The refuse from the paper mills is so profuse in quantity that the river at times is discolored for a considerable distance.

The private water supply is obtained from wells both dug and driven, from 12 to 15 feet into the gravel which underlies the whole city. In the central and lower portion of Middletown the well water cannot be of good quality owing to the pollution caused by the deep vaults.

Twin Creek. This stream drains quite an extensive watershed on which are located a few very good villages together with the following smaller ones: Johnsville, Farmersville, Winchester, Lanier, New Lexington, Eldorado, Pyrmont, Euphemia, West Baltimore, Verona, Gordon, Sonora, Ethica, West Manchester, Castine. These have a combined population of 3,200, and number among their industries some dozen saw mills, two tile works, two creameries, flour mills, planing mills, cider presses, elevators, etc.

Germantown. Population 1,702. This is quite an old but substantial village, which has slipped away from the path of industry much to its detriment. Its industries at present consist of a flour mill, creamery, cigar factory, tobacco warehouses and a distillery some distance outside of the corporation. There are a few storm sewers in the village but none for house drainage, and every one must use the out-door vault. The construction of these is not regulated, and many of them are never cleaned.

The water supply is from private wells both drilled and dug from 18 to 25 feet into a bed of gravel underlying the village.

West Alexandria. Population 740. This village has a very good public water supply but no sewers beyond a few storm water drains. Vaults are constructed to suit the owner and quite a number are never

cleaned, new ones being dug to replace the old ones. A large number of people still obtain their drinking water from wells dug from 18 to 35 feet into a bed of gravel found below the clay.

Lewisburg. Population 560. This is a growing village now supporting a grist mill, two saw mills, grain elevators and a stone quarry, some of the product of which is burned for lime.

Clear Creek. This stream drains the villages of Springborough, Red Lion, and Dodds, the total population of which is 650, and whose industries consist of a few saw mills and a creamery.

Great Miami River.

Franklin. Population 2,724. This village has a public water supply and a few short combined sewers which carry direct to the Great Miami River the sewage of some 400 people. The houses not accessible to the sewers are provided with vaults constructed in any manner but which must be cleaned out and the contents hauled to the country. Some garbage is hauled out to the farms but much of it is dumped into the river.

The industries consist of four paper mills, flour mill, saw mill, and two slaughter houses in Clear Creek. One of the paper mills and the saw mill are furnished with water power from the river.

Private wells obtain their water from the sand and gravel only a few feet below the surface.

Carlisle. Population 260. The drainage from this village reaches the river through a small creek.

Miamisburg. Population. 3,941. This village has no public water supply and no sewers beyond a few storm water drains. Surface drainage is to the canal and the river. Formerly the construction of vaults was not regulated and they were never required to be cleaned but now they must be water-tight and the contents must be hauled regularly to the country.

In the way of industries there are three paper mills, several tobacco warehouses, a foundry, two large carriage factories, a wheel factory, twine factory, flour mill, planing mill, etc. Two of the paper mills, the planing mill, and the flour mill are run by water power. The water supply is from private wells, the majority of which are dug from 30 to 35 feet into a gravel bed, while a few are driven through this gravel and into a soft stone below a layer of hardpan.

Bear Creek. On this small watershed are to be found the villages of Gettersburg, Liberty, and New Lebanon, the combined population of which is 440 and whose sole industries consist of one or two saw mills.

Great Miami River.

West Carrellton. Population 987. This village is situated a short distance back from the river on the Miami and Erie canal, to which

some of its surface drainage goes. It has a public water supply but no sewers except a short one for storm drainage. The construction of vaults is not regulated and the ground water is no doubt seriously polluted by the careless methods in use.

The sole industry of the village consists of a large paper and pulp mill which employs some 700 people, many of whom are from the neighboring towns. The waste from this plant together with the sewage from a large portion of the employes goes direct to the canal.

The private water supply is obtained from wells driven from 20 to 26 feet into the gravel.

Alexanderville. Population 200. The inhabitants of this village are employed at the West Carrollton paper mill. Just above the village the canal furnishes water power to a flour mill.

Montgomery County Infirmary. Population 414. All the inmates and officers of this institution have the use of sewerred closets, the waste from which is first purified in an intermittent filtration plant before being turned into Opposum Creek, which carries it to the river.

National Soldiers' Home. Population 4,850. This institution, a city in itself, is furnished with its own water supply and an extensive sewer system which carries the liquid wastes of every kind direct to the Great Miami River. From this one institution more sewage is sent to the river than from any city in either watershed, with the one exception of Dayton.

Dayton State Hospital. Population 960. This asylum, located just south of Dayton, has a complete system of sewers and a water supply under pressure. The sewage is emptied direct to the Miami and Erie canal at a point west of the institution.

Dayton. Population 85,333. This city is the largest in both watersheds, and the fifth largest city in the state. It is situated at the junction of Mad and Stillwater rivers with the Great Miami River and is the site of one of the earliest settlements in the Miami valley.

The city has an excellent public water supply and extensive systems of both sanitary and storm sewers. To the former it is estimated that some 30 per cent. of the people have access, and that some 15,000 have the use of the same. All the sanitary sewage is conducted to one out-fall sewer which carries it direct to the Great Miami River at a point opposite the lower portion of the city. The storm water drainage together with a large portion of the industrial wastes is emptied into the various water courses, including the canal and hydraulic, at the most convenient point. The large per cent. of the population not accessible to the sewers still use the ordinary out-door vaults, but their construction is regulated to some extent and they are required to be cleaned as necessary. Garbage, dead animals, and some night soil are cremated in the municipal crematory in the southern part of the city. Some night soil is carted to the country and disposed of on the farms. This crematory

contains four Dixon furnaces, fired with both coke and natural gas; the former however is only used to burn the offensive gases given off during the cremation. The garbage is collected and brought to the furnace by five two-horse and three one-horse self-dumping wagons. For the year ending February 1, 1900, there were cremated 66,765 bushels of garbage, 6,754 barrels of night soil, 892 dogs, and a few horses and miscellaneous animals. The plant is operated by three men, at a cost per year of \$1,719.75 for labor, \$4,278.66 for fuel, and \$2,076.25 for repairs, principally grate bars, or a total of \$8,074.66. For the same year \$1,729.81 was collected for the destruction of refuse for private parties, making the net cost of operation \$6,244.85. The ash from the furnaces is dumped on low ground near the plant.

There is a large and varied assortment of industries in and near the city, which send a considerable quantity of objectionable waste to the streams. Among these are nine breweries, several large slaughter and packing houses, a lard oil mill, linseed oil mills, four soap works, gas works, a number of paper mills, a strawboard works, etc., together with a large number of plants for general manufacturing, the waste from which is not so objectionable.

Owing to the excellent quality of the city water supply the use of private wells is being discouraged, although there are of necessity quite a number still in use. These are both dug and driven from 30 to 60 feet into the gravel which underlies the city.

Wolfe Creek. This stream enters the Great Miami River at Dayton, bringing to the latter the drainage from Arlington, Wengerlawn, Amitz, and Salem, in addition to that of Trotwood and Brooksville. The first villages named have a total population of 520, and a list of industries including three saw mills and a flour mill.

Trotwood. Population 214. This village has a public water supply which was introduced for fire protection and is not in general use for domestic purposes. The private water supply is from wells driven from 21 to 26 feet through hard-pan into gravel. This is protected to some extent by compelling all vaults to be made fairly tight and to be cleaned out as often as necessary.

The industries consist of a creamery, canning factory, saw mill, wagon works, incubator factory, etc. All drainage is direct to Wolfe Creek through surface ditches and gutters.

Brookville. Population 869. The industries of this village consist of a flour mill, grain elevators, tobacco warehouses, creamery, machine shop, etc. The drainage of these is direct to south branch of Wolf Creek.

Mad River. This drains the large eastern part of the Great Miami watershed, including nearly all of Clarke and Champaign counties.

Hershmantville. Population 300. This was the site of a large paper mill which was destroyed by fire a number of years ago. There was also developed here an extensive water-power which ran an oil mill,

malt house, flour mill, saw mill, etc. The flour mill has now been turned into a shoe factory which uses some of the water power.

Fairfield. Population 312. The drainage of this village, which supports a small saw and grist mill, is carried by a small creek to Mad River.

Dry Run. On the watershed of this small creek there are the villages of Sulphur Grove and Brandt, whose combined population is 300 and whose industries consist of a saw mill and cider press.

Mad River.

Osborn. Population 948. This village has a public water supply which is as yet not in general use; shallow driven wells supplying nearly all the water for domestic purposes. Owing to the lax methods of constructing vaults, and in caring for them, the ground water cannot help but be polluted, and the use of the public supply should be encouraged. The industries consist of a saw and planing mill, three flour mills, two run by water-power, a whip factory, bed spring factory, etc. The village has no sewers; all drainage is direct to the river and mill-race.

Medway. Population 300. An electric railroad power house is located here.

Donnell's Creek. Donnellsville, Northampton, and Dialton are situated on this stream. Their total population is 450 and their industries consist of a few saw mills, a cider press, feed mill, and tile mill.

Mad River.

Enon. Population 295. This is a quiet village about a mile back from the river.

Noblesville. Population 100. Dry Run brings the drainage from this village to the river. Its industries consist of a tomato canning factory, sorghum mill, cider press, and saw mill.

Masonic Home. Population 160. This institution consists of one large building, fitted with all modern improvements, situated on the high ground back from Mad River and overlooking Springfield. Its sewage is carried direct to the river.

Buck Creek. Just before this stream joins Mad River it receives the sewage of Springfield, Knights of Pythias Home, Odd Fellows Home, and of the Clarke County Infirmary. Just above Springfield the main stream turns to the north and quite a large tributary, Beaver Creek, comes in from the east.

Springfield. Population 38, 253. This city has a good public water supply as regards quality, but a very poor sewer system. Including private sewers it is estimated that some 20 per cent. of the people have access to the system and that some 3,000 have the use of the same. Those not accessible to the sewers use vaults, very few of which are

tight, but all of which must be cleaned as necessary. Garbage and night soil are dumped and buried along the banks of Mad River just below the city. Dead animals are boiled down in two small plants and the waste thrown into the river or fed to hogs. It is hard to imagine a method of disposing of the refuse of a city that is filthier, more unsanitary, and more objectionable in every way than the one used in this city. To this fated spot on the banks of a once beautiful river there is a continual stream of garbage and night soil wagons and dead animals. The disposition of this stuff is not supervised in any way and it takes but a very short visit to convince one of the fact that it is cared for in any but a sanitary manner.

The industries of Springfield consist of several large agricultural implement works, together with a great number of metal-working concerns; such as foundries, iron mills, engine works, machine shops, etc. These are supplemented by the usual general manufacturing establishments, flour mills, saw and planing mills, ice plants, gas works, a brewery, etc.

On account of the good quality of the city water, private wells are used only when necessary. They are usually dug from 15 to 40 feet deep into the gravel and sand found below the surface soil.

Knights of Pythias Home. Population 136. This institution obtains its water supply from the Springfield water works, and the sewage of all its residents goes direct to a Springfield sewer, making it rather a part of the city than an isolated institution.

Odd Fellows Home. Population 173. This Home also obtains its water supply from the Springfield water works, but its sewage is sent direct to Buck Creek.

Clarke County Infirmary. Population 162. For general purposes this institution uses the Springfield city water, but the drinking water is obtained from shallow dug wells. It is estimated that at least 150 of the officers and inmates use indoor closets sewerred to a mill-race leading to Buck Creek. The few remaining use outdoor vaults.

Clarke County Children's Home. Population 85. All the residents of this Home use closets sewerred to a small run which empties into Buck Creek. The water supply is obtained from a number of 50 foot wells.

Beaver Creek. On the watershed of this stream there are the small villages of Harmony, Plattsburg, Vienna Cross Roads, Brighton, and Orchard. The total population of these is 775, and their industries consist of three saw mills, a tile mill, and the usual small slaughter houses.

Buck Creek. On this creek above Springfield are located the villages of New Moorfield, Catawba, Powhatan, and Mutual, the population of which is 625. Their industries consist of two or three saw mills, a cider press, creamery, and a water-power flour and feed mill. At one time there were several water-power flour mills on this creek, and two abandoned ones are still standing near Powhatan.

Mad River. This stream above Springfield drains quite a number of small villages and the larger village of St. Paris and the city of Urbana.

Chapman Creek. On this stream a short distance back from the river is the village of Tremont, with a population of about 400, and the following industries: saw mills, a water-power flour mill and feed mill, and a slaughter house.

Storm Creek. Farther back from the river on this creek is Terre Haute, a village containing some 90 people and a saw mill and cider press.

Nettle Creek. On this watershed are the villages of Westville and Millerstown, the combined population of which is 400, and whose industries consist of a saw mill, hoop factory, and fertilizer works.

St. Paris. Population 1,222. The drainage from this village goes to Nettle, Storm and Chapman creeks. Beyond grain elevators and a flour mill it has no industries.

Mad River.

Champaign County Infirmary. Population 77. The sewage from some 50 of the occupants of this institution is carried to a cesspool which overflows to a small run leading to the river. The others use unsewered vaults. The water supply is from the Urbana water works, a spring, and a 50 foot dug well.

Dugan Creek.

Urbana. Population 6,808. This city has a public water supply but as yet no sewers whatever beyond a few short storm water drains. It is probable, however, that the creek receives the sewage from a number of places through private sewers. A number of water closets are sewerred to cesspools dug down into the gravel so as to require less frequent cleaning. Vaults are also dug down to gravel and when full are covered over and new ones dug. Very few cesspools or vaults are ever cleaned out.

The private water supply is obtained from this same and deeper stratas of gravel and cannot help but be of uncertain quality.

The industries of the city consist of a woolen mill, dye house, straw-board works, fruit canning and packing houses, creamery, car shops, artificial ice plant, gas works, and some general manufacturing.

Champaign County Children's Home. Population 55. The sewage from the entire population of this Home is sent to cesspools which overflow of Dugan Creek. The water supply is obtained from the Urbana water works.

Mad River. Above Urbana this river drains the villages of King's Creek, Kennard, Cable, Mingo, West Liberty, and Zanesfield. The total population of these is 2,300, of which the largest, West Liberty, has

1,236. The industries include three or four saw mills, three small water-power flour mills, two of which are but little used, a creamery, and a few cider presses.

Stillwater River. This river joins the Great Miami at Dayton, and brings in the drainage from nearly all of Darke county and portions of Montgomery, Preble, and Miami counties, and a small portion of Indiana. Up to Ludlow Creek the river drains the village of Little York, Union, Fidelity, Nashville, and West Milton. These have a total population of 1,850, of which West Milton has 904. The industries consist of four saw mills, a creamery, woolen mill, cider press, and two flour mills, with several more feed and flour mills scattered along the river.

Ludlow Creek. On the drainage area of this creek are the villages of Ludlow Falls, Laura, New Lebanon, Phillipsburg, and Pittsburg. These have a total population of 1,160, and their industries consist of four saw mills, a flour mill and a cider press.

Stillwater River.

Pleasant Hill. Population 557. The industries of this village consist of a canning factory, saw mill, and plaster works.

Painter Creek. This brings in the drainage from Painter Creek, Delisle, and Arcanum, which villages have a total population of 1,425, of which 1,125 belong to Arcanum alone. The industries of this group consist of three saw and planing mills, two flour mills, a creamery and a cider press.

Stillwater River.

Covington. Population 1,791. This village has neither a public water supply nor a sewer system. Vaults are usually very shallow on account of the nearness of the rock to the surface, and the surface drainage after rains must carry off much objectionable matter.

The local industries consist of a creamery, woolen mill, flour mill, lime kilns, stone quarries, and tile and brick yards. Private wells are 8 to 10 feet deep, most of them drilled into the rock.

Greenville Creek. In addition to the city of Greenville this creek drains the villages of Bradford, Gettysburgh, New Harrison, Weaver's Station, Palestine, Coleville, Hillgrove, and Barton; the latter in Indiana. Bradford has a population of 1,254, and the remaining number a total population of about 1,000. The industries consist of the railroad shops at Bradford and several saw mills, flour mills, a cider press, cane mills, etc., scattered through the district. A number of these are run by water power furnished by Greenville Creek.

Greenville. Population 5,501. This city, the county seat of Darke County has an excellent public water supply and one of the best sanitary sewer systems in the watershed. It is estimated that 80 per cent. of the people have access to this system, but on account of its newness only 200

people as yet have the use of the same. The sewage is at present discharged through one outlet sewer direct into Greenville Creek. The surface drainage is cared for by gutters and the few old combined sewers which were in place, supplemented by one new line.

Vaults are required to be water-tight but very few comply with this regulation, especially the old ones. Night soil and garbage are disposed of individually on the neighboring farms.

The industries consist of a few saw mills, tile mills, and machine shops. The private water supply is obtained from wells dug about 25 feet into the gravel found below the surface soil and clay.

Darke County Infirmary. Population 80. This institution is located a few miles south of Greenville and its sewage and surface drainage go to a branch of Greenville Creek. It is estimated that some 60 of its occupants use sewered closets. The water supply is obtained from two 80 foot driven wells. Pressure is obtained by pumping the water together with a certain amount of air to a horizontal steel tank where the air is compressed, forcing the water through the pipes when the pumps are not running.

Stillwater Creek. Above Covington this stream drains one of the most level sections of the watershed. In addition to Versailles this district contains the following villages: Horatio, Bloomer, Webster, Dawn, Frenchtown, Beansville, Stelvedio, Pikeville, Ansonia, Woodington, Hagerman, Rossville, New Weston, Burketsville, and Lightsville; the combined population of which is some 2,700, with 676 for Ansonia, the largest of the group.

The industries of these villages consist of a large number of saw mills and hoop, handle and stave factories, one or more for each village, with the addition of a few flour mills, tile mills, cider presses, etc.

Versailles. Population 1,478. This village is now putting in a water works, the supply to be obtained from a number of driven wells in the valley of Swamp Creek. The public water supply was badly needed as the water from the shallow private wells was of poor quality.

There are as yet no sewers in use: storm water is cared for by ditches and gutters. Vaults are but rarely found, shallow pits, boxes, etc., being used almost entirely. Garbage and refuse are dumped in several low places near the village, caused by the excavation of gravel for railroad work.

The industries consist of a creamery, cider press, two saw mills and a chicken packing house.

Darke County Children's Home. Population 70. This Home is north of Greenville, with its drainage going to a branch of Stillwater Creek. About 40 of its residents have the use of sewered closets, the remainder using vaults. It will be noted that the drinking water is obtained from a shallow dug well, while the water for general use comes from a number of deep driven wells.

Great Miami River. Just above Dayton the river receives the drainage from Chambersburg, Vandalia, West Charleston, and Ginghamburg, the total population of which is 660, and whose industries consist of a few saw mills.

Honey Creek. On this watershed are the villages of Miami City, New Carlisle, and Addison; the total population of which is 1,470, with 995 of this for New Carlisle. Among the industries are two flour mills and several saw mills and planing mills.

Lost Creek. In addition to the County Children's Home this stream drains Casstown, Fletcher, and Lena; the total population of which is 790, and for which three saw mills constitute the total industries.

Miami County Children's Home. Population 71. The drainage from this place it drains to Lost Creek. It is estimated that the average number of its residents using sewered closets is 21, the remaining 50 using out-door vaults. The water supply is from a number of dug wells, located some distance from the buildings.

Great Miami River.

Tippecanoe City. Population 1,703. This village has a public water supply and a number of combined sewers which empty into the Miami and Erie canal. It is estimated that about 20 percent of the people have access to these sewers, but as yet they are used by only some 25 persons. The old vaults are merely holes in the ground, but the new ones must be water-tight. Garbage and night soil are dumped in an old gravel pit south of town and also along the canal.

The industries consist of a bent works, two whip factories, straw-board works, furniture factory, and the usual saw mill and flour mills; the latter run by water-power from the canal. A distillery is now being put in and will soon be in operation. Nearly all of the industrial wastes are sent to the canal. Private wells are from 5 to 25 feet deep, plenty of water being found in the gravel under the surface soil.

Troy. Population 5,581. This city, the county seat of Miami County, has a public water supply and a few short combined sewers. It is estimated that some 15 percent of the people have access to the sewers, and that some 850 people have the use of the same when the large number of private sewers are included. Vaults are constructed in any and every way, but must be cleaned out as necessary. Garbage and dead animals are buried in a sandy island below town, and garbage is dumped here and along the river.

Among the industries of this place are two distilleries, two breweries, several quite large slaughter houses, and a number of carriage and wagon factories; also dash and pole and shaft works. A flour mill below town is run by water-power from the river.

The private water supply is from shallow wells, both dug and driven into the gravel found through this whole section.

Miami County Infirmary. Population 75. This institution is located just north of Troy and only a short distance back from the river. On an average 60 of its residents have access to closets sewered direct to the Great Miami River. The water supply is from a shallow driven well.

Piqua. Population 12,172. The public water supply for this city is obtained from the "hydraulic" and is not used for domestic purposes. For this use water is obtained from private wells, a large number of which are dug from 15 to 30 feet into the gravel and a few are drilled 35 to 40 feet deep, getting into the limestone below the gravel.

Piqua has the separate system of sewers with about 30 percent of the people accessible to the sanitary system, and with some 600 persons having the use of the same. The sanitary sewers lead to one outfall sewer which empties into the Great Miami direct. Vaults are required to be water-tight, but the regulation is not enforced. A school house even has put in a cesspool which reaches the same gravel strata from which the drinking water is obtained only a short distance away.

The principal industries consist of four woolen mills, two straw-board works, three linseed oil mills, two breweries, a malt house, creamery, rolling mill, stove works, several large slaughter houses, and a large amount of general manufacturing. The industrial wastes go both to the canal and to the river, and cause a nuisance in both at times.

Loramie Creek. The head-waters of this stream are impounded in Loramie reservoir for the supply of the Miami and Erie canal. Besides the village of Minster there are on the watershed the smaller villages of Lockington, Houston, Dawson, Russia, Wyant, Loramie, Osgood, Yorkshire, North Star, and Botkin. These have a total population of something over 1,800 and their industries consist of eight saw mills, three creameries, a flour mill, and a few tile mills.

Minster. Population 1,465. The surface drainage of this village goes to the canal and to a creek leading to the canal. As there are no sewers these same waterways receive the drainage from the various manufacturing establishments, among which are a creamery, two shoddy mills, two barrel factories, a flour mill, machine shop, etc.

Water is obtained from shallow wells dug in the gravel, and from deeper wells drilled to rock.

Great Miami River.

Shelby County Infirmary. Population 47. This infirmary is three miles southwest of Sidney, and its surface drainage and sewerage are to Rock Run, a small tributary of the Great Miami. It is estimated that about 30 of its residents use sewered closets. The water supply is from three wells from 98 to 105 feet deep.

Sidney. Population 5,688. This city has a public water supply but as yet only a few short sewers, though a complete sanitary system is under way. To the present sewers, which empty into the Great Miami

River, it is estimated some 15 percent of the people have access, but only about 530 persons are now using the same. The construction of vaults and cesspools is not regulated and the many in existence cannot help but be a nuisance to the few shallow private wells still in use. The local industries consist of a brewery, tannery, two hollow-ware plants, and a number of general manufacturing plants making brooms, carriages, poles and shafts, flour, scrapers, whips, etc.

Shelby County Children's Home. Population 47. This Home is located just east of Sidney on the high ground overlooking the Great Miami River. Every one has access to closets, sewerage direct to the above named stream. The water supply is obtained from the Sidney water-works and from a spring.

Mosquito Creek. This creek enters the Great Miami at Sidney, bringing in the drainage from Plattsville, New Palestine, Rosewood, and Carysville. The total population of these is 450, and their industries consist of a few saw mills and a creamery.

Plumb Creek. On the watershed of this stream are the villages of Swanders and Anne, the combined population of which is 750, and whose industries include a number of saw mills, a creamery, and a flour mill.

Great Miami River.

Port Jefferson. Population 355. This is a quiet old village located at the head of the feeder which joins the canal at Lockington. Its only industry consists of a saw mill.

Pemberton. Population 250. Little Indian Creek carries the drainage of this place a short distance to the river. Among its industries are a grain elevator, saw mill, and cider press.

Quincy. Population 642. The industries supported here are a water-power flour mill on the river, a handle factory, saw mill, and creamery.

Stony Creek. A few miles back from the river there is located on this stream the village of Spring Hill. Population 157. Some of the surface drainage at Bellefontaine also reaches this stream.

Great Miami River.

De Graff. Population 1,150. This village has as yet neither a public water supply nor a sewer system. On account of the large number of shallow pits and boxes used as vaults the surface drainage is no doubt objectionable after rains. Water is obtained from private wells, both dug and driven from 20 to 80 feet into the gravel.

Buckinjahalis Creek. This stream drains both the county infirmary and children's home, and also a portion of Bellefontaine.

Logan County Children's Home. Population 46. This institution is located one and one-half mile west of Bellefontaine. The waste from the laundry, kitchen, and several closets, accessible to perhaps ten of the res-

idents, is carried direct to the creek. The water supply is obtained from wells driven from 40 to 53 feet deep.

Logan County Infirmary. Population 68. This infirmary is located on Flat Branch Creek, a tributary of the above, some three and one-half miles northwest of Bellefontaine. Its drainage, together with the sewage from closets accessible to only eight persons, goes direct to the creek. The water supply is also from driven wells 30 to 40 feet deep.

Bellefontaine. Population 6,649. This village has a public water supply but no sanitary sewers whatever, and only a few short storm-water drains. The surface drainage goes to both Buckinjahalis and Stony creeks. It is claimed that there are a few water closets connected with the storm sewers, but the majority in use drain to cesspools. Vaults and cesspools are dug down to gravel, but they must be cleaned out when necessary, and the contents disposed of on farms.

Among the industries are the railroad shops, three carriage factories, a saw mill, creamery, and the ever present slaughter house, the latter being out of the city however.

Private wells are being abandoned for the city water, those in use, however, are both dug and driven into the gravel found just below the surface.

Great Miami River.

Loganville. Population 150. No industries.

Hodge Creek.

On this stream is the village of Maplewood, the population of which is 200, and whose industries consist of a tile mill, saw mill and grain elevator.

Wolf Creek.

On this watershed are the villages of Bloom, Sante Fe, Geyer, Jackson Center, Montra, New Hampshire, and Waynesfield. The total population is about 2,200, and their industries consist of a large number of saw mills and stave mills, also a planing mill, three tile factories, a flour mill, creamery, and excelsior factory.

Great Miami River.

The head-waters of the main stream are impounded in Lewistown Reservoir for the supply of the Miami and Erie canal. On the watershed are the villages of Lewistown, Lake View, Huntsville, New Richland, and Belle Center. The combined population of these is about 2,180, and their industries consist of several cider presses, saw mills, and stave factories, also a creamery, shoe factory, stirrup factory, tile and brick works, etc.

b. LITTLE MIAMI RIVER.

Tributary direct to the Little Miami River in some of the surface drainage of the extreme eastern part of Cincinnati.

Mt. Washington. Population 781. This village is located on the hills east of the river, with its drainage reaching the latter by the way of several small runs. Its only industry seems to be a canning factory.

Duck Creek.

This overburdened stream brings into the Little Miami River the sewage from a large number of the suburbs of Cincinnati, and some of the storm drainage of that city.

Madisonville. Population 3,140. This village has a public water supply but as yet no sewer system. Its surface drainage is to the east fork of Duck Creek. Many water-closets drain to cesspools which, with most of the vaults, are dug some 10 feet deep and walled up. When full many of these are cleaned out but a number have been covered over and new ones dug. The only industry is a planing mill, many of the inhabitants being employed in Cincinnati. The private water supply is from wells dug from 45 to 75 feet deep.

Madeira. Population 125.

Kennedy Heights. Population 209.

Silverton. Population 250.

Pleasant Ridge. Population 953. About half of the population of this village drains to Duck Creek.

Oakley. Population 528. This village has been piped for water to be supplied from the Cincinnati works, but the connection has not been made as yet. A number of streets were recently paved and a few short storm sewers put in.

Norwood. Population 6,480. Only half the population of this village is tributary to Duck Creek. Norwood has a public water supply and an extensive system of both sanitary and storm sewers. On the Duck Creek side it is estimated that about 75 percent of the people have access to the sanitary sewers and that they are used by some 1,600 persons. No new vaults are allowed and every house is supposed to be sewered, though of course there are a large number of the older ones which are not as yet connected. Garbage is disposed of individually by dumping in any convenient place away from the city. The industries consist of a large playing card factory, electric supplies factory, washing machine factory, furniture factory, and tool works. There are only a few private wells now in use.

Hyde Park. Population 1,691. It is estimated that about 1,000 people of this village are in the Duck Creek drainage area. The village is supplied with water from Cincinnati, but has no sewers except storm water drains. A private sewer to Duck Creek is used by some 250 people. The village is a residence district for Cincinnati and has no industries.

Evanston. Population 1,716. About 1,000 people in this village are tributary to Duck Creek. The public water supply is obtained from Cincinnati but in contrast to Hyde Park this village has a complete system of sanitary sewers. It is estimated that about 95 per cent. of the population have access to these sewers and that they are used by some 375 people.

Dairy Farms. Along Duck Creek there are a number of large dairy farms from which a large amount of very objectionable drainage reaches this stream.

Little Miami River.

Up to the entrance of the East Fork the river receives the drainage of Newton, Plainville, Terrace Park, and South Milford, the combined population of which is some 1,200, and whose industries consist of two water-power flour mills at Plainville.

East Branch of the Little Miami River.

This stream drains a large hilly section of the watershed, including portions of Clermont, Brown, Highland, and Clinton counties. On this area there are a large number of very small villages, which have no industries whatever and which for all purposes of this investigation can be ignored.

Perrinville. Population. 150. No industries.

Stone Lick Creek.

On this stream are the villages of Boston, Monterey, Newtonville, and Edenton, the combined population of which is 700, and whose industries consist of small flour mills.

East Branch of the Little Miami River.

Clermont County Infirmary. Population 75. This institution is situated on the "Branch" only a few miles below Batavia. About 50 of its residents have the use of closets sewered to a cesspool which overflows to the above mentioned stream. The main building is built on rather low ground making it difficult to carry the sewage away. The water supply is obtained from springs and a shallow dug well.

Batavia. Population 1,029. This city has a public water supply, just recently introduced, and a number of storm sewers emptying into the river. Vaults are usually very shallow and seldom cleaned out, new ones being dug as required. The bulk of the water used for domestic purposes is taken from private wells dug from 25 to 50 feet through the clay and into the gravel below. The only industries are a brick and tile works, and a small water power grist mill.

Above Batavia the watershed consists of a long and narrow strip of territory extending up nearly to Fayette County. In this area are

the villages of Williamsburg, Lynchburg, and New Vienna, and a host of smaller places, among which are Amelia, Marathon, Fayetteville, St. Martin, Westboro, Midland, Dodsonville, and Martinsville. The total population of these smaller villages is 3,350, and their industries include a number of flour and saw mills, a canning factory, a tile mill, etc.

Williamsburg. Population 1,000. This is a quiet old place in the midst of the hills of Clermont County.* In addition to its numerous stores with which to supply the wants of the neighboring farmers it has a flour mill and two chair factories.

Lynchburg. Population 907. This village has a public water supply but no sewers whatever. Its surface drainage and the wastes from its industries go direct to the creek. Vaults are but seldom dug, boxes being used almost entirely. The private water supply is from shallow wells dug into the surface strata of sand and gravel. The industries consist of a large distillery, a brick and tile mill, and a saw mill. The distillery runs from October to July and makes up into whiskey some 750 bushels of corn a day for the above season. The refuse from the stills is fed to steers, some 1,000 of which are kept for this purpose. The animals are being fattened for the market and so are kept confined in small pens. The drainage from these is led to a pond or settling basin from which the liquid portion is run to the river and the solid parts used for fertilizer. At times all of this refuse is sent direct to the creek. The whole establishment is dirty and foul-smelling in the extreme and the creek is polluted for miles, and to such extent that fish cannot live. No serious complaint seems to be made as the plant is the life of the town.

New Vienna. Population 805. This village is situated at the very headwaters of the East Branch. Its industries consist of two flour mills, two saw mills, creamery, cider press, and stone quarry.

Little Miami River.

From the East Branch to Loveland this river receives the drainage of Terrace Park, Milford, Camp Dennison, Miami-ville, Remington, Montgomery, Hazlewood, and Symmes. The total population of these is some 2,700, with 1,159 for Milford, the largest of the group. The industries of these places include a number of flour mills and saw mills and a canning factory.

Loveland. Population 1,260. There are a number of storm drains from this village to the river which carry a considerable amount of kitchen and some closet drainage, causing a nuisance at times. As there is no public water supply a number of places are provided with the means for storing rain water with which to flush the closets.

The industries consist of a large creamery, flour mill, canning factory etc. The water for domestic use is obtained from shallow dug wells and from cisterns.

Obanon Creek.

This stream brings in the drainage from Goshen, a small village of some 250 people and Cozaddale, with only 50 people, but at the latter place there is a creamery.

Little Miami River.

Between Loveland and Morrow the river receives almost directly the drainage from Fosters, Miamiville, King's Mills, and Deerfield, and less directly that from Mason. The combined population of these is some 2,100, and their industries consist of a number of flour mills, saw mills, and canning factories, the latter at Deerfield; also a large powder and cartridge factory at King's Mills. There is an abandoned salt well at Mainville.

Turtle Creek.

Lebanon. Population 2,867. This village, the county seat of Warren County, has both a public water supply and a few short combined sewers. It is estimated that 5 per cent. of the people have access to these, but as yet they are in-use by only 30 persons. New vaults are required to be water-tight but old ones are constructed in the usual unsanitary manner. Private wells are usually dug from 12 to 60 feet deep. The industries consist of a flour mill, saw mill, and creamery.

Warren County Children's Home. Population 40. This institution is located a short distance west of Lebanon, and is supplied with water from the water works of that village. All of the occupants have access to closets sewered direct to Turtle Creek.

Warren County Infirmary. Population 110. This infirmary is situated here on high land across Turtle Creek from Lebanon. It is supplied with water from the Lebanon water works and from two dug wells. Its entire population has access to closets sewered to a cesspool which drains and overflows to the creek.

Little Miami River.

Morrow. Population 869. This village is situated at the confluence of Todd's Forks and the Little Miami River. Its industries consist of a creamery, brewery, saw mill and flour mill, the latter run by water power obtained from the river.

Todd's Fork.

In addition to Blanchester, Wilmington, and the Clinton County Homes, this watershed contains the villages of Pleasant Plain, Butlerville, Clarksville, Cuba, New Antioch, and Ogden. The total population of these latter is something over 1,200, and their industries consist of several saw mills, two flour mills and a pickle factory.

Blanchester. Population 1,788. This village has a public water supply, but the water is not fit for domestic use; shallow dug wells and cis-

terns furnish water for this use. The village has neither sanitary nor storm sewers. A number of buildings are provided with water closets sewerred to cesspools and some of which overflow to Second Creek, a branch of Todd's Fork. As a rule all vaults and boxes are cleaned and the contents taken to the country.

The industries consist of two hame factories, tile mill, creamery, canning factory, machine shops, saw mill, and flour mill.

Wilmington. Population 3,613. This large village has neither a public water supply nor sewer system. There are a few private sewers, from houses and buildings, which empty into a small run causing a nuisance at times. Boxes are in general use in preference to vaults, and they are usually kept clean. Night soil and garbage are disposed of on the neighboring farms. The local industries include a bridge works, auger bit works, shoe factory, flour mill, saw mills, creamery, slaughter houses, etc. The water supply is from private wells dug from 20 to 25 feet into the gravel, a few going 50 to 60 feet into the shale and limestone.

Clinton County Children's Home. Population 27. This house is situated just west of Wilmington. It is not provided with a sewer of any kind, and its water supply is obtained from an ordinary dug well; in every way it is like a large farm house.

Clinton County Infirmary. Population 94. This institution, situated just east of Wilmington, is provided with a sewer for kitchen and laundry drainage only. All the occupants use unsewered closets. The water supply is from shallow dug wells.

Little Miami River.

Fort Ancient. Population 50. This place is interesting from the fact that on the hills above it, overlooking the river, there is a very fine and extensive example of the prehistoric earth-works.

Freeport. Population 120. There is located here a good water power flour and saw mill, and a bridge works.

Caesar's Creek.

On the watershed of Caesar's Creek there are the villages of Harveysburg, New Burlington, Paintersville, Lumberton, Port William, Bowersville, Bloomington, New Jasper, and Jamestown. The total population of these is about 3,000, of which 1,205 belongs to Jamestown. The industries consist of a large number of saw mills, several flour mills, and one or two creameries and tile mills.

Little Miami River.

Waynesville. Population 723. This village is now putting in a public water supply. At present the water for domestic use is obtained from

shallow wells dug down through the soil and gravel to the rock. A few water tight vaults are in use but the majority consist of very shallow holes, nearly all of them are cleaned, however. The local industries consist of water power flour mill and saw mill, a creamery, and wood-working shop.

Corwin. Population 131. This village is just across the river from Waynesville and is the railroad station for that place.

Mt. Holly. Population 175. There is a small flour mill and distillery here.

Spring Valley. Population 522. This village supports quite a large flour mill and a few saw mills.

Sugar Creek.

This small stream drains Bellbrook, Centerville, and Beavertown, the combined population of which is 800, and whose industries consist of a few saw mills only.

Beaver Creek.

On the watershed of this stream are the villages of Alpha and Zimmerman, the total population of which is some 250. Each place supports a small water power feed mill.

Little Miami River.

Trebeins. Population 40. There is located here a large flour mill operated by water power obtained from the river.

Shawnee Run.

Xenia. Population 8,696. This city, the county seat of Greene County, has a public water supply but as yet no sewers except a few short combined ones, put in originally for storm water only. A new system of sanitary sewers has been planned, including an intermittent filtration disposal works, and it is expected that these will be put in during 1901. To the present sewers it is estimated that 10 percent of the population has access and that they are used by some 60 persons. There are quite a number of water-closets in use which are sewerred to cesspools, some of which may drain to the sewers.

The law requires that vaults be water tight though but few of the older ones are so constructed. Many old vaults have been abandoned and covered over without cleaning. Garbage is fed to hogs, many of which are kept in town. The industries include a strawboard works, an old brewery, shoe factory, five cordage works, and the usual saw, flour, planing and tile mills.

There are a number of private wells still in use though they are gradually being abandoned in favor of the city's supply.

Ohio Soldiers and Sailors Orphans' Home. Population 1,010. This large institution is situated just southeast of Xenia on Shawnee Run. It has its own water supply, and a sewer system to which are connected water-closets accessible to all the occupants of the Home. The sewage is supposed to be pumped to settling pits in the rear of the buildings, but the pump is too small to handle all of it and some overflows from the collecting well to Shawnee Run, causing a much complained of nuisance. The settling pits are not properly cared for and offer but little chance for sedimentation. The overflow from these goes to Gladys Run which enters the Little Miami River at Spring Valley.

Little Miami River.

Greene County Children's Home. Population 36. This Home is located a few miles northwest of Xenia on a small run going direct to the river. The waste from the kitchen and laundry is led to this ravine but the sewer carries no water-closet drainage. The water supply is obtained from a spring.

Greene County Infirmary. Population 100. This institution is northwest of Xenia near the Children's Home. All its occupants have the use of water-closets sewered to a ravine leading to the river. The water supply is obtained from a well and a spring.

Massick's Creek.

In addition to Cedarville this stream drains the villages of Wilberforce, Selma, and Grape Grove. The total population of these is 550, and their industries consist of a few saw mills and tile mills.

Wilberforce College. Attending this school are some 330 students, with 27 officers and instructors. The latter, only, have access to water-closets sewered to the creek, the others using out-door vaults. Water is supplied from a number of springs.

Cedarville. Population 1,189. This village has quite a number of industries, among which are a strawboard works, water power flour mill, two saw mills, stone quarry and lime kilns, tile works, brick yards, etc. As the rock is very near the surface vaults are as a rule shallow, but are kept cleaned out. The water is obtained from private wells dug 30 to 40 feet in the rock. The refuse from the strawboard works is carried in a flume some distance below town and is emptied into a five acre reservoir. This is supposed to intercept all suspended matter and prevent the usual nuisance in the creek, but it does not seem to be a success.

Little Miami River.

Goe's Station. Population 300. The industry of this place is a quite extensive powder mill.

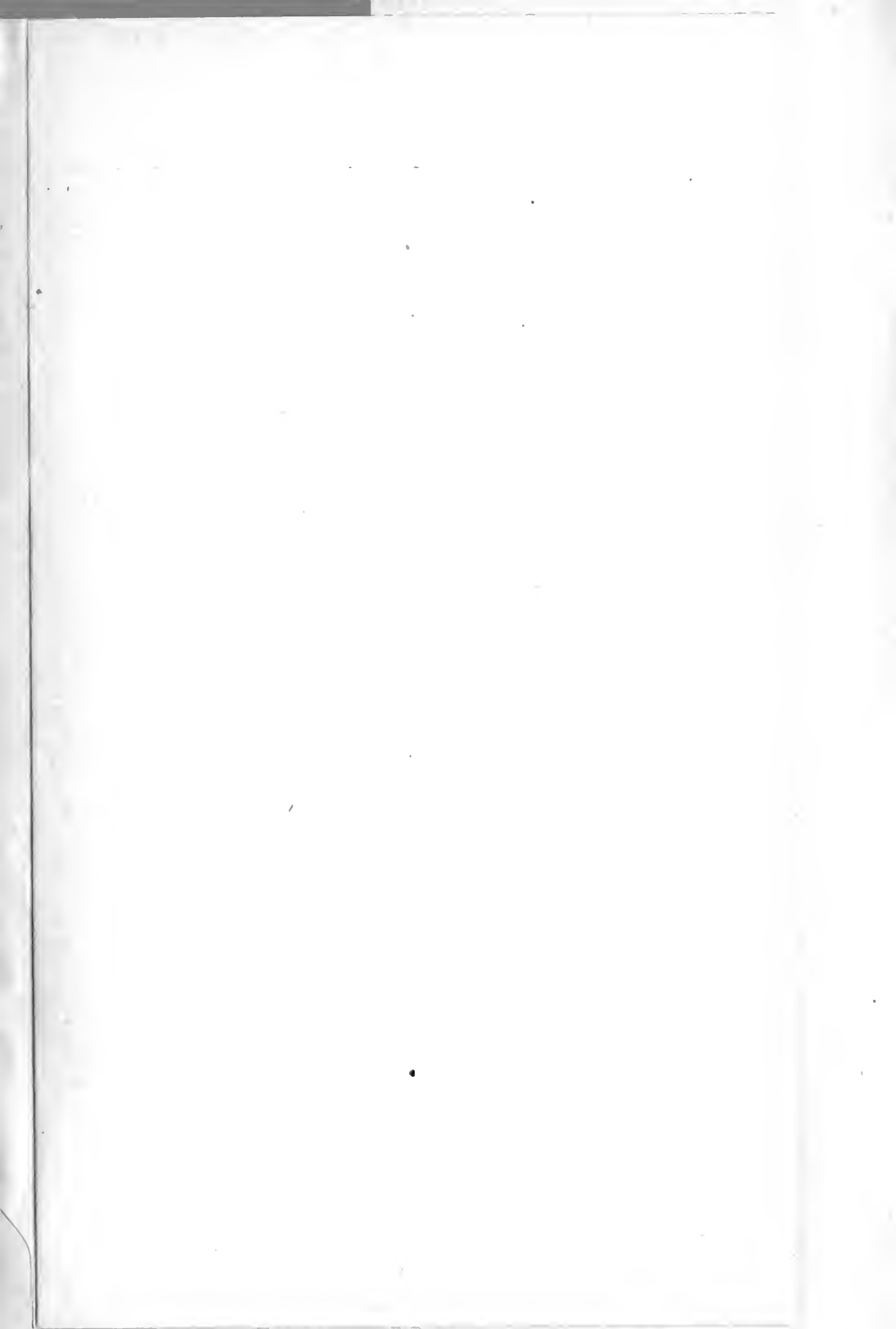


TABLE IV—SEWERAGE OF TOWNS.

Number.	Name of Town.	Population.	Kind or System of Sewers.	Method of Disposal.	Outlets.	Number.	Number of Miles of Sewer.	Percent. of Population Accessible to Sewers and Private Sewers.	Number of Closets or Vault Connections to Sewers, Including Private Sewers.	Estimated Population Using Sewers.	Percentage of Total Population Using Sewers.	Does the Sewage Cause a Nuisance.	Remarks.
1	Batavia	1,029	Storm ..	Dilution	East Fork Little Miami river.....	2	0.8	0	0	0	0		
2	Bellefontaine	6,649	Storm ..	Dilution	Opossum run		2.0	0	0	0	0		A few closets connected to the storm sewer.
3	Blanchester.....	1,788	None		Surface drainage to Second creek.....		0	0	0	0	0		Several cesspools overflow to the creek.
4	Dayton	5,333	Separate.	Dilution	Sanitary to Great Miami river.....	1	Sanitary, Storm, 47.00 50.00	30	1,700	15,000	18	Local nuisance in low water.....	Six miles sanitary under construction.
5	Easton	7,155	Storm ..	Dilution	Seven Mile creek.....			0	0	0	0		All water closets drain to cesspools.
6	Evanson	1,000	Separate.	Dilution	Sanitary to Duck creek		3.4	95	75	375	37	All summer and fall	*Includes portion in the Miami Watershed only. Balance of village drains to Bloody Run.
7	Franklin	2,721	Comb'n'd	Dilution	Great Miami river.....	2	0.4	30	20	100	4	No ..	
8	Greenville	5,501	Separate.	Dilution	Sanitary to Greenville creek	1	Sanitary, Storm, 16.5 3	80	30	200	4	Not as yet.	Twelve miles in place, remainder under construction.
9	Hamilton	23,914	Separate.	Dilution	Sanitary Great Miami river	3	Sanitary, Storm, 18.8 4.9	65	800	4,700	20	Local nuisance at all times.....	
10	Hyde Park.....	1,060	None		Surface drainage to Duck creek.....		0	25	50	270	25	All summer and fall	*Includes portion in the Miami Watershed only. Balance drains to Crawfish creek. N. 50 houses sewered privately to Duck creek.
11	Lebanon	2,897	Comb'n'd	Dilution	Turtle creek	1	0.3	105	6	50	1	At times.....	Sewer put in for storm water only.
12	Lynchburg	907	None		Surface drainage to East Fork Turtle creek		0	0	0	0	0		
13	Madisonville	3,110	Storm ..	Dilution	Branch of Duck creek		0.5	0	0	0	0		All water closets drain to cesspools.
14	Middletown	9,215	Comb'n'd	Dilution	Great Miami river.....		7.2	80	350	2,000	22	Local at times.....	
15	Norwood	2,100	Separate.	Dilution	Sanitary to Duck creek	1	Sanitary, Storm, 11.0 2.5	75	300	1,000	50	All summer and fall	*Includes portion in the Miami Watershed only. Balance drains to Bloody Run.
16	Osborn	948	None		Surface drainage to Mad river.....		0	0	0	0	0		All closets drain to cesspools.
17	Oxford	2,069	None		Surface drainage to Brill Run and Seven Mile creek.....		0	0	0	0	0		Several private sewers to ditches.
18	Piqua	12,172	Separate.	Dilution	Sanitary Great Miami river	1	Sanitary, Storm, 4.4 8.0	30	105	600	5	No (?)	
19	Sidney	5,688	Comb'n'd	Dilution	Great Miami river	2	1.4	15	70	350	6	During low water	Sewers put in for storm water only. New system proposed.
20	Springfield	38,253	Comb'n'd	Dilution	Duck creek	8	10.0	20	500	3,000	8	Summer and fall	Mill creek practically a sewer. Sewers put in for storm water only.
21	Tippecanoe	1,793	Comb'n'd	Dilution	Miami canal	4	2.0	20	5	25	1	At times.....	
22	Trotwood	214	None		Surface drainage to Stillwater river.....		0	0	0	0	0		
23	Troy	5,881	Comb'n'd	Dilution	Great Miami river.....		0.5	15	175	850	15	At times.....	Large number of private sewers to river, race and ditch.
24	Urbana	6,808	Storm ..	Dilution	Dugan creek	1	0.3	0	0	0	0	Surface drainage at times.....	All water closets drain to cesspools.
25	Versailles	1,478	None		Surface drainage to Swamp creek		0	0	0	0	0		
26	Waynesville	723	None		Surface drainage to Little Miami river.....		0	0	0	0	0		
27	W. Alexandria	740	Storm ..	Dilution	Twin creek	1	0.5	0	0	0	0		All water closets drain to cesspools.
28	W. Carrollton	987	Storm ..	Dilution	Miami canal	1	0.2	0	0	0	0		
29	Xenia	8,026	Comb'n'd	Dilution	Shawnee creek and branches	10	1.2	10	10	60	1	All summer and fall	New sanitary system under way. Sewers put in for storm water only.
			None 8 Storm 7 Comb'n'd 8 Septic 6 39	All dilution.....			Storm, Average, 67.7 Combined, Average, 27.0 Separate, Average, 104.1 Average, 17.4	Ave 36	Total, Average, 4,187 Average, 280	Total, Average, 29,140 Average, 1,943	Ave 14	13 cause more or less nuisance; 3 no nuisance as yet.	

Population in sewered towns 267,187—87%. Population in unsewered towns 39,675—13%. Total 237,762—100%. Accessible to sewers, 67,146—33% of population in sewered towns—28% of population in all towns. Using sewers, 29,140—14% of population in sewered towns—12% of population in all towns. Portion of storm drainage of Cincinnati goes to Duck Creek.

Yellow Springs. Population 1,371. The sole support of this village is the educational institution located here, Antioch College. Neither the village nor the college has a water supply other than private wells, or any sewers whatever.

Clifton. Population 262. There is quite a picturesque water power flour and saw mill located here.

South Charleston. Population 1,096. The industries of this place include a saw mill and tile mill, a flour mill and a creamery. There are three short sewers in the village for cellar drainage only. Vaults are usually very shallow and many are covered over instead of being cleaned out. The water supply is from private wells both dug and drove, some 15 to 20 feet through the surface soil and clay into the gravel and quicksand below.

2. SEWERAGE OF CITIES AND VILLAGES HAVING PUBLIC WATER SUPPLIES.

In this section there has been collected the general details of the sewer systems previously referred to, also a tabular statement is given for convenience in reference and comparison. In a few cases the table will give all the information that there is to give and no further mention of these will be made in the text.

Batavia has but recently introduced a public water supply and sewage can be expected from this village in the near future.

Bellefontaine is one of a number of towns in this watershed that are situated so near the head-waters of the stream to which they are tributary that it is impossible to dispose of any quantity of sewage by dilution alone and some method of purifying the same must be secured along with the introduction of a sanitary or combined system. It is contrary to an ordinance to send house drainage to the storm sewers, but it is generally understood that some is disposed of in this way.

Dayton was until 1890 supplied with a very inadequate system of combined sewers. During the above year a sanitary system was designed for the city and work at once started to install the same and turn the old combined sewers into a storm water system. Now there are 47 miles of sanitary sewers in, with six additional miles under construction. It is estimated that 30 percent of the total population have access to the sanitary sewers, now in place, and that 18 percent have the use of the same. This latter figure was arrived at from the fact that there are 1,700 connections to the sewer system and 2,832 water-closets on the water works mains. The sanitary sewers all lead to one outlet sewer which empties into the Great Miami River, in the lower part of the city, at a point opposite the waste way from the hydraulic and two of the large storm sewers. The sewage causes a local nuisance in times of extreme low water, but there seems to be no cause for complaint on this account as the outlet is removed from the immediate vicinity of dwellings. During high water, in order to discharge the sewage into the river, it is

necessary to lift it some 16 feet, for which purpose a 20,000,000 gallon pumping plant has been installed. This consists of two 12-inch centrifugal pumps, actuated by two 40 horse-power steam engines, with each pump and engine so arranged as to work interchangeably as a safeguard against a complete failure of the plant from accident. The six miles of sanitary sewers which are now under construction are in the northern part of the city in low lying ground from which, in order to carry the sewage to the present system, it will be necessary to lift the same some five feet. This small head is to be overcome by two Shone ejectors, which will be operated by compressed air furnished from the water works pumping station. There are about 50 miles of storm water sewers in, covering practically the whole city and emptying at the most convenient points into the Great Miami, Stillwater and Mad rivers, the Miami and Erie canal, the hydraulic, and various creeks and ditches. It is stated that there are still a number of house connections to these sewers, it being almost impossible to get every drain diverted to the sanitary system.

Evanston has both storm and sanitary sewers emptying into both Bloody Run and Duck Creek, the latter only a tributary of the Miamis. In the whole village there are six miles of sanitary sewers, which are accessible to some 95 percent of the people and are in use by 29 percent. While in the area within the Little Miami watershed, there are 3.4 miles of sanitary sewers which give 95 percent of the population in the area access, and are used by some 37 percent of the same portion of the total population. The sewage sent to Bloody run adds to the general filth of the Mill Creek valley and that portion going to Duck Creek causes more or less of a nuisance during the summer and fall.

Franklin. The few short sewers in this village were originally put in for storm purposes only, but the construction of the water works favored the introduction of baths, water-closets, etc., the easiest drainage for which were the storm sewers already in place.

Greenville is now completing one of the best sanitary sewer systems in the district. It has already completed 12 miles of sewers with 4.5 under way, which, when completed, will give some 80 percent of the people access to the same. There are at the present time, however, only 30 connections to the system, representing a very small percent of the population, but it is expected that during the coming year there will be a large increase in the above number. For three years the sewage is to be discharged direct to Greenville Creek, but after this time purification will be required, as it was thought that by the time this period should elapse there would be discharged into the creek a quantity of sewage sufficient to cause a nuisance.

Hamilton also has a good system of sanitary sewers, with three outlets to the Great Miami River. Here also, as in Dayton, during exceptionally high water it is necessary to raise the sewage from the main outlet sewer, some 16 or 17 feet in order to discharge it into the river.

For this purpose there has been installed a pumping plant consisting of two 12-inch centrifugal pumps actuated by two steam engines. The plant has a capacity of some 15,000,000 to 20,000,000 gallons daily, and has been in use but twice, in the month of February of 1897 and 1898. In all there are 18.8 miles of sanitary sewers in, giving some 65 percent of the total population access to them. It is estimated that some 4,700 people, or 20 percent of the total number, have the use of the sewers.

Hyde Park. The surface drainage of Hyde Park goes both to Crawfish Creek and to Duck Creek. There are no sanitary sewers in and all house drainage is to cesspools or through private sewers to the creek. It is estimated that in the latter way Duck Creek receives the drainage from some 50 houses. This sewage causes a nuisance in warm weather and is much complained of.

Lebanon has a few short combined sewers, originally intended for storm water only, which carry from a few houses enough sewage to cause more or less nuisance in Turtle Creek, a very small stream. This village belongs to the list of towns in which purification will be required for the discharge from any extensive system of sanitary sewers.

Madisonville. Attention must be called to the total lack of sewerage in Madisonville, one of the numerous villages serving as a resident place for workers in Cincinnati. This village contains a large number of very fine residences in which, according to the water-works books, there are only 49 water-closets. All these drain to cesspools, as there is no system whatever of sanitary drainage.

Middletown. About 30 percent of the population of Middletown have access to some 7.2 miles of combined sewers. This system has five outlets to the Great Miami River into which the sewage is emptied with but little nuisance on account of the great dilution.

Norwood is within the drainage areas of both Bloody Run and Duck Creek, and its storm and sanitary drainage is to both streams. In the whole city there are 22 miles of sanitary and five miles of storm sewers, to the former of which some 60 percent of the population is accessible and 43 percent has the use of. In the area within the Little Miami watershed there are 14.0 miles of sanitary sewers and 2.5 miles of storm sewers. It is estimated that one-half of the total population is on the Duck Creek drainage area and that 75 percent of these have access to the sanitary sewers draining to Duck creek, and that some 50 percent of the same have the use of the sewers. The sewage emptied into Duck Creek causes a very objectionable nuisance for the greater part of the summer and fall.

Piqua has the separate system of sewers with some 4.4 miles of sanitary sewers and 3.0 miles of storm sewers now in place. About 30 percent of the total population has access to the sanitary sewers, but only one-sixth of these, or 5 percent of the total, have as yet taken advantage of them.

Sidney has quite a number of combined and semi-private sewers leading to the Great Miami River, which are made use of by some 6 percent of

the total population. These drains have given rise to much complaint on account of the nuisance caused by them and it is intended to install a new sanitary system. In order to further this much needed improvement permission has been given by the Board to send the sewage direct to the river until such time as purification shall be required on account of a nuisance or other proper consideration.

Springfield has 10 miles of combined sewers to which it is estimated that some 20 percent of the city's population have access and some 8 percent the use of. These sewers empty through 12 outlets into Mill Creek and Buck Creek, both small streams, where during the warm months the sewage stagnates and causes a very objectionable nuisance. Just above the confluence of Mill Creek and Buck Creek there is, in the former stream, a dam which impounds a large part of the sewage, causing a most foul nuisance, nearly in the center of the city. This same creek, Mill Creek, runs through the heart of the city, being arched over in places, and receives filth of every description, which its very small flow is not able to carry away, adding further to the nuisance. It seems that according to the local ordinances Springfield has only storm sewers and that house connections are not allowed to be made to the drains, certainly a relic of its childhood. This law, as seen, is not observed, even the city building being connected to one of the so-called storm sewers. The facilities for collecting and disposing of sewage in this, the eighth city of the state, can be considered nothing short of disgraceful.

Tippecanoe City has a few short combined sewers, emptying into the Miami and Erie canal, which, while they are accessible to quite a percent of the population, are but little used for house drainage.

Trey is traversed by three waterways which receive the drainage from a few short combined sewers and from a very large number of private sewers. With these latter included it is estimated that some 25 percent of the population are accessible to the sewers and that 15 percent have the use of the same.

Urbana. There is no means for the disposal of house drainage except by private cesspools. It is hardly necessary to state that in a city of this size and furnished with a public water supply, this condition cannot help but be objectionable and that a sanitary sewer system should be put in at once.

West Alexandria also has no sanitary sewers and all water-closets have to be drained to cesspools, but on account of the small number in use it is not as yet as objectionable as in a larger place.

West Carrollton. None of the houses of West Carrollton have as yet been provided with the so-called "modern conveniences."

Xenia has 1.2 miles of sewers designed at first for storm-water only, but now carrying house drainage, which empty into Shawnee Run and its tributaries, causing a very objectionable nuisance. A complete sanitary system has been designed for this city which will shortly be put in.

The outfall sewer is to be carried below the city in the valley of Shawnee Run, where intermittent filtration beds are to be put in for the purification of the sewage before turning it into the run.

It will be noted that the storm drainage of a small portion of Cincinnati goes to Duck Creek, but it is not believed that any considerable amount of sewage reaches that stream from this city.

Of the 29 cities and villages given in Table 4 as having public water supplies, eight have no sewers whatever, seven have a few storm water drains only, eight have a more or less extensive system of combined sewers, and six have the separate system of sewers, with, in this case, the sanitary system quite well developed. The sewage is disposed of in every case by dilution alone.

In all there are 67.7 miles of storm sewers, or an average of 6.2 miles for each of the 11 places for which the mileage could be secured.

Of the combined sewers there are 23.0 miles, an average of 2.9 miles for each of the eight given, while for the sanitary there are 104.1 miles, an average of 17.4 for each of the six given.

For the fifteen towns, including Hyde Park, which have sewers for house drainage, the average percent of the total population accessible to these sewers is 36. In these same towns it is estimated that the total number of closet connections to the sewers is 4,197, representing some 29,140 people, or an average of 280 connections and 1,943 people for each town. The average percent of the total population using the sewers is 14.

Of the total population in these 29 cities and villages, 207,187, or 87 percent, live in those having more or less extensive systems of combined or sanitary sewers, while 30,575, or 13 percent, live in those which have as yet no sewers for carrying off house drainage. In all there are 67,148 people living in houses accessible to the sewers, which is 33 percent of the total population of the sewered towns. There are of those who actually have the use of sewers only 29,140, or 12 percent of the total population, and 14 percent of the population of the sewered towns. Thus it is seen that less than one-half of the people so fortunate as to live in houses within reach of sewers have as yet taken advantage of them. After a sewer has been constructed there is much still to be done before the full benefit of the improvement is secured.

Returning to a consideration of the individual systems it appears that in 13 cases, which include the storm sewers of Urbana and the private sewers of Hyde Park, the discharge of sewage into the various streams has caused more or less of a nuisance while in three only has there been no nuisance caused as yet.

The sewage from none of the cities and villages in the Great Miami watershed discharges into a stream from which a public supply is taken, in Ohio. In the Little Miami watershed the sewage from Evanston, Hyde Park, Lebanon, Norwood, and Xenia, affects the water supply of

Cincinnati, which is at present drawn from the Ohio river below the Little Miami. By water, these places are the following distances above the present intake of the Cincinnati water works: Evanston, 16 miles; Hyde Park, 16 miles; Lebanon, 42 miles; Norwood, 15 miles, and Xenia, 76 miles. The emptying of sewage into the streams at Batavia, Blanchester, Lynchburg, Madisonville and Waynesville, would also influence the supply for Cincinnati. These sources of pollution need not be seriously considered, however, as the quantity of sewage is small, the dilution enormous, and the distance very great except in the cases of Evanston, Hyde Park and Norwood; also on account of the fact that the water supply of Cincinnati is much more seriously polluted by the sewage of that city itself, and the fact that a new supply is being developed above all these sources of pollution before mentioned.

The water supply for Batavia is drawn direct from the East Branch of the Little Miami River at a point 47 miles below Lynchburg, but as long as the water is properly filtered there is little danger from the introduction of a sewer system in the latter village, or from the large amount of filth from the distillery and cattle pens which at present enters the stream.

3. SEWERAGE OF ISOLATED PUBLIC INSTITUTIONS, WITH NOTES ON WATER SUPPLIES.

It will take but a brief review of this section in order to appreciate the necessity of including these isolated institutions in any investigation of the sources of pollution of a watershed. On account of a number of large institutions in addition to the usual county homes, it is even more important that they should be included in this study than in any of the former investigations of this character. For many of the institutions all the necessary information is given in concise form in Table 5, and no further mention need be made of these.

As seen, this table notes for each place the source of the water supply for both domestic and general use. Where necessary these notes will be elaborated on in the text following.

Dayton Soldiers' Home. This national home for old soldiers, located one mile west of the Dayton corporation line, has a total population, including officers and attendants, of 4,850. These are housed on the cottage plan with each building heated with steam from a central plant. They are also sewered and provided with water. The water supply is obtained from 16 driven wells, located some distance east of the institution and within the corporation of Dayton. The water is found at a depth of from 45 to 55 feet in a bed of gravel overlaid with hardpan. The well site is surrounded with vaults and cesspools many of which go through the layer of hardpan which is only 12 feet thick. While this condition seems to have caused no trouble as yet, it is certainly an undesirable one and may lead to a serious pollution of the supply. The normal

TABLE V—ISOLATED PUBLIC INSTITUTIONS—SEWERAGE AND WATER SUPPLY.

Number.	Name of Institution	Location	Average population, including students.	Water Supply.		Average number of persons using sewered closets, etc.	Average number of persons using unsewered closets.	Sewerage.	General Drainage to—	Remarks.
				For Domestic Use.	For General Use.			Method or Place of disposing of Sewage.		
	MISCELLANEOUS									
1	Soldiers Home	West of Dayton	4 850	16 wells 45 to 50 feet deep	Same	4,850	0	Great Miami river	Same	
2	State Hospital	South of Dayton	900	8 wells 30 feet deep	Same	900	0	Ohio canal	Great Miami river	
3	Miami University	Oxford	150	Oxford water works	Same	150	0	Empties into cesspools draining to Four-Mile creek	Four-Mile creek	Present for 10 m'nths only.
4	Oxford College	Oxford	135	Oxford water works	Same	135	0	Small branch of Bull run	Four-Mile creek	Present for 10 m'nths only.
5	The Western	Oxford	150	Cistern	Well	150	0	Field draining to Bull run	Four-Mile creek	Present for 10 m'nths only.
6	Oxford Retreat	Oxford	50	Oxford water works	Same	70	0	Four-Mile creek	Same	
7	Ma-ome Home	West of Springfield	169	Wells 40 feet deep	Same	169	0	Mad river	Same	
8	Knights of Pythias Home	North of Springfield	136	Springfield water works	Same	136	0	Buck creek	Same	
9	Old Fellows Home	North of Springfield	173	Springfield water works	Same	173	0	Buck creek	Same	
10	Wilberforce College	Wilberforce	357	Springs	Same	27	330	Massack's creek	Same	
11	Ohio Soldier's and Sailor's Orphan's Home	Xenia	1 010	4 wells 65 to 100 feet deep	Same	1,010	0	Portion sent to beds draining to Gladly run, remainder to Shawnee run	Shawnee run	Population less in summer.
	COUNTY CHILDREN'S HOMES									
1	Champaign	East of Urlana	55	Urbana water works	Same	55	0	Empties into cesspool overflowing to run	Dugan creek	
2	Clark	North of Springfield	85	Wells 50 feet deep	Same	85	0	Empties into dry run	Buck creek	
3	Clinton	West of Wilmington	27	Wells 50 feet deep	Same	0	27		Todd's Fork	
4	Darke	North of Greenville	70	Wells 11 feet deep	4 wells 95 to 115 feet deep	30	40	Ditch	Stillwater creek	
5	Greene	N. W. of Xenia	36	Spring	Same	0	36	Small run	Little Miami river	
6	Logan	W. of Bellefontaine	46	Well 53 feet deep	Well 40 feet deep	10	36	Sent to cess-pool draining to field	Buckinjahalis creek	
7	Miami	East of Troy	71	Well 40 feet deep	Same	21	50	Lost creek	Same	
8	Preble	S. W. of Eaton	54	Well 22 feet deep	Eaton water works	0	54	Branch of Seven Mile	Seven-Mile	Soon will be sewered.
9	Shelby	East of Sidney	47	Soring	Sidney water works	47	0	Great Miami river	Same	
10	Warren	West of Lebanon	40	Lebanon water works	Same	40	0	Turtle creek	Same	
	COUNTY INFIRMARIES.									
1	Butler	East of Hamilton	152	Hamilton water works	Same	152	0	Sent to open pit	Ohio canal and Crawfish run	
2	Champaign	South of Urbana	77	Well 50 feet deep	Urbana water works	50	27	Sent to cesspool overflowing to run	Mad river	
3	Clarke	North of Springfield	162	Wells 10 feet deep	Springfield water works	150	12	Mill race leading to Buck creek	Buck creek	
4	Clermont	N. W. of Batavia	75	Spring and 12-foot well.	Spring	50	25	Sent to cesspool overflowing to run.	East fork of Little Miami rvr	
5	Clinton	East of Wilmington	94	Wells 13 feet deep	Same	0	94	Sewer will empty into run	Todd's Fork	
6	Darke	South of Greenville	86	2 wells 80 feet deep	Same	60	26	Branch of Greenville creek	Same	
7	Greene	N. W. of Xenia	100	1 well 211 feet deep	Well and spring	100	0	Small ravine	Little Miami river	
8	Logan	N. W. of Bellefontaine	68	Well 40 feet deep	2 wells 30 feet deep	8	60	Flat Branch creek	Same	
9	Miami	North of Troy	75	Wells 23 feet deep	Same	60	15	Great Miami river	Same	
10	Montgomery	West of Dayton	414	3 wells 18 to 30 feet deep	Pond fed by spring	414	0	Intermittent filtration	Great Miami river	
11	Preble	N. W. of Eaton	55	4 wells 25 to 30 feet deep	Eaton water works	29	35	Sent to cesspool draining to Seven-Mile creek	Seven-Mile creek	
12	Shelby	S. W. of Sidney	47	3 wells 98 to 105 feet deep	Same	30	17	Rook run to Great Miami river	Same	
13	Warren	South of Lebanon	110	2 wells 35 feet deep	Lebanon water works	110	0	Sent to cesspool overflowing to creek	Turtle creek	
34	Totals		10 191			9,313	878			

level of the water in the wells is 35 feet from the surface, and it is lowered but little by ordinary pumping. The supply is pumped direct from the wells to a large open reservoir by two horizontal duplex Smith-Vaile pumps of 1,000,000 gallons capacity each. The reservoir has an area of some 12 acres with an average depth of 20 feet, and serves as a boating course for pleasure parties, a practice certainly to be condemned. Water from fountains, grottoes, etc., also flows back to this lake to prevent wastage. From the lake the water is pumped to a standpipe by a 1,000,000 gallon horizontal compound duplex Smith-Vaile pump and an 800,000 gallon horizontal compound duplex Gordon-Maxwell pump. In this station there is shortly to be installed a new 5,000,000 gallon pump as the present capacity is insufficient. The stand-pipe is 18 feet in diameter, 148 feet high, and has a capacity of 280,000 gallons. The average daily consumption is estimated at 1,600,000 gallons, or 330 gallons per capita of the population of the institution. If the above figures are correct it shows clearly that somewhere there is an enormous wastage of water. Sewered closets are provided for the use of every one on the ground. The waste from closets, buildings, etc., is carried through an 18-inch outfall sewer, four miles long, to the Great Miami River, and there disposed of by dilution. At one time much of the solid matter was disposed of in compost pits, but these have been abandoned as a nuisance.

Dayton State Hospital. This is an asylum for the insane and is located just south of the city limits of Dayton. The average number of inmates is 830, with seven officers and 123 employes. Originally the water supply was obtained from a number of springs, but these became unsatisfactory and in 1896-8 eight 30-foot wells were put down from which the present supply is obtained. The water is pumped direct from the wells to a 90,000 gallon standpipe by a horizontal compound duplex Laidlaw-Dunn-Gordon pump of 1,000,000 gallons capacity and a small Smith-Vaile pump which is little used. The wells do not seem to give a satisfactory water and it is proposed to put down a new set near the old springs. All the buildings are provided with water-closets which are sewered to the Miami and Erie canal, one mile west of the institution.

Miami University. This university is located at Oxford and has an average of 150 students and instructors, none of whom live in the institution proper and only a small percent of whom are present during the summer. The water supply for both drinking purposes and general use is obtained from the village water-works. Formerly much of the drinking water was obtained from a well but this became contaminated, probably from a defective sewer, and its use was prohibited. The buildings are provided with water-closets, the waste from which led into two cesspools, draining to Four Mile Creek. These cesspools or tanks were designed to give purification by the septic process, but they either were carelessly built or have since been so neglected that they cannot be given much credit.

Oxford College. This college, for women, is located at Oxford and has some 135 students and instructors present and living in the institution for the usual school year. Its water supply is obtained entirely from the village water-works. The buildings are fitted throughout with water-closets, which are sewered to Bull Run, a branch of Four Mile Creek. During warm weather this sewage causes a nuisance which is rightfully complained of.

The Western. This college, also for women, is located at Oxford and has attending and living in it some 150 students and instructors. Its water supply for domestic use is obtained from a cistern, while a well near Four Mile Creek supplies the water for general use. The buildings are supplied with water-closets, the waste from which is emptied out on a field draining to Bull Run, a branch of Four Mile Creek.

Oxford Retreat. This is a private sanitarium, having on an average some 70 patients and attendants. It is supplied with Oxford village water for all purposes. It is fitted with all modern conveniences, sewered direct to Four Mile Creek.

Masonic Home. This institution, located just west of Springfield, is supported by private enterprise and has some 160 residents and attendants. Its water supply for both domestic and general use is obtained from a well 40 feet deep. The buildings are fitted throughout with water closets, sewered direct to Mad River.

Knights of Pythias' Home, and Odd Fellows' Home. These are each private institutions, supported by the orders for which they are named. The total number of residents and attendants in each is 136, and 173 respectively. They are both situated on the high ground just north of Springfield and each is supplied with the city water. They are also fitted with all modern conveniences, and sewered direct to Buck Creek; the former, however, through a part of the Springfield system.

Wilberforce College. This is an educational institution for colored youths, and is situated in the village of Wilberforce, Greene County. It has some 357 students and instructors, with the majority of the former living in the institution proper, the remainder in the village around. The water supply for the college is pumped from a spring and distributed through the buildings. Indoor water-closets are provided for the officers only, some 27 persons, while the students use unsewered closets.

Ohio Soldiers and Sailors Orphans' Home. This large institution, situated just southeast of Xenia, has a population of some 1,010 people including officers and attendants. As it is more of a school than a permanent home, the summer population is much smaller than for the remainder of the year. The institution is on the cottage plan, with each building supplied with water, gas, steam, etc., from central plants located on the grounds. The buildings are also provided with sewered closets accessible to inmates as well as officers. The sewage is led to a large cesspool from which it is supposed to be pumped to open pits or beds in

the rear of the buildings. These beds are supposed to collect the solid matter and to allow the liquid portion to seep away into the soil. Not only are the beds a failure, but the sewage pump is too small to handle all the sewage and at times much of it overflows to Shawnee Run, where it causes a nuisance much complained of by the residents of Xenia, through which the run passes. Further details of the water supply and sewerage of this institution are given in a special report to be found elsewhere in this volume.

County Children's Homes. Both the inmates and officers of the Champaign, Clark, Shelby and Warren County homes have the use of the sewered closets. In Darke, Logan and Miami County homes the officers have the use of sewered closets at all times, while the inmates use the same during the night only or in bad weather. The Clinton, Greene and Preble County homes are not provided with sewered closets; in fact the Clinton County home does not even have a sewer for waste water. The Preble county home is now being improved and will soon be fitted with modern plumbing. The sewers from the Champaign and Logan County homes are first led to cesspools in which much of the solid matter is collected, the liquid draining to Dugan and Buckinjahalis Creeks. The Champaign and Warren County homes are supplied respectively with the Urbana city and the Lebanon village water, while the others have private water supplies from wells and springs.

County Infirmaries. Only in the infirmaries of Butler, Greene, Montgomery and Warren counties do both inmates and officers have the use of sewered closets, while in all the rest except the Clinton County infirmary, the officers and a portion only of the inmates have the use of such modern conveniences. The sewers from the Champaign, Clermont, Preble, and Warren County infirmaries lead to cesspools, which overflow to the neighboring streams. The Butler County infirmary also sends its sewage to a pit from which much of the liquid soaks away, the remainder going direct to a small tributary of the Great Miami River. If the cesspool is properly constructed and cleaned out when necessary, this method of caring for a small amount of sewage prevents to a certain extent, the nuisance which must always be caused by sending sewage to a stream too small to care for it by dilution.

The Darke, Greene, Logan, and Shelby County institutions send their sewage to small streams and to runs where, for a part of the year, it causes quite a nuisance. The Clarke County infirmary is fortunately situated near a body of water large enough to dispose of its sewage in a satisfactory manner by dilution alone.

The largest of the infirmaries and the one having the only modern method of caring for its sewage is that for Montgomery County. This institution is situated a few miles west of Dayton and at such a distance from the Great Miami River that it would be very expensive to reach that stream with an outfall sewer. A small tributary of the above named

river drains the infirmary farm but it is much too small to care for the sewage of 414 people. Plans were prepared by Robert E. Kline, County Surveyor, for an intermittent filtration plant to care for the sewage of this institution, and in June 1899 they received the approval of the Board, and the works were put in during the same year. The sewage from all the building is collected in an 8-inch outfall sewer leading through a screen chamber into a storage reservoir from which it is discharged periodically onto the filter beds by means of an automatic flushing device. The reservoir consists of a covered brick and concrete chamber 14x20x16 feet deep and holding some 12,000 gallons. Before reaching this reservoir the sewage is freed from its coarse suspended matter by passing it through a screen box or basket placed in a circular chamber and so arranged that it can be drawn up and emptied. With the present consumption of water the reservoir discharges once every 24 hours onto the filter beds. There are eight beds now in use, each 50 by 62.5 feet, giving a total effective area of little more than half an acre. The beds contain a 3 to 4 foot layer of filtering material, consisting of a thin layer of screened gravel, then unscreened gravel, and finally a layer of sand. The beds are placed in two rows of four each, with a carrier running in the center of the levee between the rows. From this carrier there leads out over each bed a half tile distributor, portions of which are broken away at intervals so that the sewage may be spread evenly over the surface. To prevent the sand from being disturbed in such distribution there is placed a small slab of stone opposite each opening on which the sewage falls as it leaves the distributor. Each set of beds is underdrained by two long lines of 4-inch tile, each line being placed 12 feet from the sides respectively. The effluent from these underdrains is collected in a 6-inch outfall sewer which empties into the above mentioned run.

As the reservoir discharges only once in 24 hours, each bed has a rest of seven days before it is used again. After the beds have dried off, the attendant rakes over the surface and collects any solid matter which may have gathered on the surface, and dumps it out on the field adjoining the beds.

After the filters were first installed there was considerable difficulty experienced in operating them, owing to the fact that the surface was allowed to become overgrown with weeds to such an extent as to make it almost impassable to the sewage. Since the beds have been raked over after each flooding there seems to have been no difficulty experienced, as the sewage disappears quickly from the surface and appears finally as a well purified effluent.

There is the usual musty odor about the disposal works but not strong enough to be objectionable. The storage reservoir has a decided odor about it, but not a more objectionable one than was coming from some fertilizer stored near it.

For the benefit of the other counties which might wish to profit the good work being done here, it will be said that the disposal works including the sewer, cost, completed, \$6,096.65.

The total number of occupants of the miscellaneous institutions is 8,151, of whom all but 330 have the use of sewered closets. It must be remembered that the occupants of a few of these places are present during a portion of the year only, and in one or two cases during a portion of the day only.

The children's homes contain 531 inmates and officers, with 288 using sewered closets and 243 not.

In the infirmaries there are 1,509 people, all but 305 of whom have access to sewered closets.

This makes for all a population of 10,191, of which 9,313 use sewered closets and 878 are not so provided. These institutions are responsible for one-third as much sewage as are all the cities and towns of both watersheds.

In not a single instance does it seem necessary to pollute the streams with the sewage from these institutions. Everything is favorable to the installation of some method of purification; the sewage is small in amount, usually in a concentrated form; it is collected in one outfall sewer; in nearly every case land is plentiful, and usually labor can be had at small or no extra expense.

4. SUMMARY.

In regard to the effect on public water supplies there is little need to summarize the contents of the previous sections.

Batavia has the only permanent surface supply and it is obtained from a stream which is not affected to any extent by sewage, as Lynchburg, the only tributary town with a water supply, is not sewered. The pollution of the stream at this point, by the distillery and its accompanying cattle pens is, however, very serious, and the Batavia filter plant should be maintained at a high state of efficiency.

The supply for Piqua no doubt receives some sewage from the feeder passing through Sidney, but as the water is so objectionable from other causes that it is not used for domestic purposes this does not matter.

Blanchester has a surface supply which is not potable for other reasons than sewage pollution. Farm drainage and mud are responsible for the poor quality of the water.

The water of Buck Creek with which Springfield helps out its ground-water does not receive any sewage pollution; in fact the stream at the intake does not drain any urban towns. The water during the the low stages of the stream is of fair quality except when compared with the excellent ground water from the gallery. It must be remembered, however, that it comes from a well populated farming district and the chance for serious pollution is ever present. These four constitute all the public supplies obtained from surface sources.

Of the total sewage pollution of the streams it will be seen that both watersheds receive the sewage of some 38,453 people, of which 34,801 belong to the Great Miami watershed, and 3,652 to the Little Miami watershed. The pollution caused by this sewage is cut down a little by the one purification and the several partial purification plants which have been put in.

It must not be thought that the above represents the total sewage population, as there are thousands of cases where the drainage from the vaults of isolated houses and manufacturing establishments is sent to the various water-courses. It is impossible to determine the number of such cases without a house to house canvass, something absolutely out of the question in work of this kind. The wide distribution of this sewage pollution is brought out by the following map, which shows the streams which receive some of this direct sewage pollution.

In the Great Miami watershed it will be seen that there are only 6 streams of any size that are not polluted by sewage.

The Great Miami river above DeGraff escapes, but on the watershed there are the large villages of Jackson Center, Lake View and Belle Center, which, if not at present, will in time be sending sewage to the stream.

Greenville Creek above Greenville and Four Mile Creek above Oxford are free from this sewage; also Loramie Creek, but the lower village of Minster is located on this watershed. Mad River above Dugan Creek receives no sewage but drains the large village of West Liberty.

Twin Creek receives no sewage but receives the drainage from Germantown, West Alexandria and Lewisburg.

There are three cases in the Little Miami River, the main stream above Massick's Creek, Caesar's Creek, and the East Branch above Batavia. These watersheds, however, include Yellow Springs and South Charleston, Jamestown and Williamsburg, and Lynchburg respectively.

With the clay land and objectionable farm drainage it would be difficult to find even a small stream which could furnish a potable water. In order to bring out the other phase of the question, that is the ability to dispose of sewage, the following table has been prepared, in which the relation of the urban population to the tributary watershed areas is shown:

TABLE VI—URBAN POPULATION IN RELATION TO WATER-SHED AREAS.

Number.	Place.	Popula- tion.	Stream.	Area of watershed in square miles.	Area per 1000 of population.	Water and Sewerage.
1	Arcanum	1,225	Painter's Creek...	5	4.1	W.
2	Batavia	1,029	East Branch Little Miami River ..	456	346.1	W.
3	Bellefontaine	6,649	Stony creek and Buckinjahalas Cr.	*	.....	W.
4	Blanchester	1,788	Second Creek....	5	2.9	W.
5	Bradford	1,254	Greenville Creek 1 mile below.....	193	153.9	
6	Portion of Cincinnati.	5,000	Little Miami River	1,706	34.1	W.
7	Cedarville	1,189	Massick's Creek...	62	51.6	
8	Cleves	1,323	Great Miami River	3,807	286.2	
9	Covington	1,791	Stillwater River ..	433	24.1	
10	Dayton	85,333	Great Miami River	2,536	29.7	W. & S.
11	Degraff	1,150	Great Miami River	390	28.7	
12	Eaton	3,155	Seven Mile Creek	21	6.6	W.
13	Portion of Evanston.	1,000	Duck Creek	1	1.0	W. & S.
14	Franklin	2,724	Great Miami River	2,680	98.5	W. & S.
15	Germantown	1,702	Twin Creek	301	17.7	
16	Greenville	5,501	Greenville Creek ..	118	21.4	W. & S.
17	Hamilton	23,914	Great Miami River	3,547	14.8	W. & S.
18	Portion of Hyde Park	1,000	Duck Creek	2	2.0	W. & S.
19	Jamestown	1,205	Caesar's Creek ...	*	.....
20	Lebanon	2,867	Turtle Creek	22	7.7	W. & S.
21	Loveland	1,260	Little Miami River	1,106	878	W. & S.
22	Lynchburg	907	East Branch Little Miami River	70	76.9	W.
23	Madisonville	3,140	Branch of Duck Cr	5	1.6	W.
24	Miamisburgh	3,941	Great Miami River	2,662	683	
25	Middletown	9,215	Great Miami River	3,075	334	W. & S.
26	Milford	1,149	Little Miami River	1,157	1000	
27	Minster	1,465	Loramie Creek ...	*	.....
28	Portion of Norwood..	3,240	Duck Creek	3	0.9	W. & S.
29	Osborn	948	Mad River	575	607	W.
30	Oxford	2,009	Four Mile Creek..	95	45.0	W.
31	Piqua	12,172	Great Miami River	863	70.9	W. & S.
32	St. Paris.....	1,222	Black Snake Run..	*	.....
33	Sidney	5,688	Great Miami River	552	97.0	W. & S.
34	Springfield	38,253	Buck Creek	155	4.1	W. & S.
			Mad River 3 miles below	447	11.4	
35	South Charleston....	1,096	Little Miami River	7	6.4	
36	Tippecanoe City....	1,703	Great Miami River	1,021	600	W. & S.
37	Trotwood	214	Wolf Creek	56	261	W.
38	Troy	5,881	Great Miami River	916	156	W. & S.
39	Urbana	6,808	Mad River	162	23.8	W.
40	Versailles	1,478	Swamp Creek	59	39.4	W.
41	Waynesville	723	Little Miami River	410	569	W.
42	West Alexandria....	740	Twin Creek	155	209	W.
43	West Carrollton....	987	Great Miami River	2,609	264.3	W.
44	West Liberty.....	1,236	Mad River	32	25.8	
45	Williamsburg	1,002	East Branch Little Miami River ...	241	240	
46	Wilmington	3,613	Todd's Fork.....	25	6.9	
47	Xenia	8,696	Shawnee Run 3 miles below.....	11	1.2	W. & S.
			Little Miami River	246	28.3	W. & S.
48	Yellow Springs.....	1,371	Yellow Springs Cr.	4	2.9	

This table includes 4 towns with Public Water Supplies but not Urban.

*Drainage area too small to measure.

According to Hazen's estimates Ohio streams require a drainage area of from 15 to 40 square miles to dispose of, in an unobjectionable manner, by dilution, the sewage of 1,000 people. From the stream gaging that has been done in Ohio it is now evident that the low flows are much smaller than was expected, especially as most of the comparisons were made with the run-off of eastern streams. Instead of a minimum of 0.1 of a cubic foot, or a little less per second per square mile of drainage area, it is found that the average flow for a month, and in some cases two months, is less than 0.01 of a cubic foot per second per square mile.

This must modify seriously the estimates of the drainage area necessary to unobjectionably dispose of the sewage by dilution of 1,000 people. If the estimate of from 15 to 40 square miles for every 1,000 inhabitants is correct when based on a minimum flow of a little less than 0.1 cubic foot per square mile, it will be necessary to allow from 150 to 400 square miles for the minimum flow as actually found.

From an extended acquaintance with conditions over the state it would seem that the latter figures are very nearly correct. In studying this question it must be borne in mind that the 1,000 inhabitants refers to the population actually sending sewage to the streams.

In Dayton, with only a little more than one-sixth of the population using sewers, a drainage area of 30 square miles per 1,000 of the total population has not prevented a slight local nuisance.

The sewage of Evanston, Hyde Park, Lebanon, Norwood and Springfield causes a nuisance in every case, as would certainly be expected.

Greenville has 21 square miles per 1,000 of its population, and will only escape a nuisance until its system comes into general use. Xenia has gone at the matter in the proper way; they intend to put in the purification plant along with the sanitary sewers.

From the size and tributary drainage areas available it is very probable that purification works will be needed in the following towns as soon as a complete sewer system is put in and comes into general use: Arcanum, Bellefontaine, Blanchester, Cedarville, Covington, Eaton, Jamestown, Lynchburg, Madisonville, Minster, Oxford, Piqua, St. Paris, Sidney, South Charleston, Urbana, Versailles, West Liberty, Wilmington, and Yellow Springs.

V. ICE SUPPLIES.

The investigation of the ice supplies for a district as extensive as the one under discussion is of necessity limited to a brief outline of the principal sources unless more time and labor than could be given to it is available.

The most evident fact noticed in a study of this question is the growing importance of the artificial ice industry. The ever increasing pollution of the streams and ponds from which the natural ice was cut, together with the more general enlightenment of the public in reference to sanitary matters, has been gradually increasing the demands for the artificial product. In a thickly settled portion of the state, as found in the Miami valleys, it is impossible to find a stream of any size which does not suffer from more or less sewage pollution. The Miami and Erie canal, together with its basins and feeders, was at one time able to and did furnish an enormous amount of very fair ice, but now this waterway receives so much refuse that from but a very small portion of the system can a usable ice be cut.

It is possible, however with proper precautions, to get good ice from the back-water of dams in the small streams and from the small natural and artificial ponds. The ice may be high in organic matter, but if the drainage areas are kept free from pollution the ice is certainly usable. In a majority of the cases, however, it will be found that not the slightest precaution is taken and that ice is cut from ponds and streams the water of which cannot help but be most foul. Frequently, the artificial ponds are kept full of water during the ice season only and for the remainder of the year are merely swampy holes full of stagnant water. Too often also cattle and hogs have access to these ponds.

In the smaller villages, and some of the larger ones also, it seems to be a general practice for the local butcher to do his own slaughtering, and also have near his slaughter house a pond from which a supply of ice is cut for his own use. No attempt is made to protect this pond from pollution as it is claimed that the ice is for cooling purposes alone and its quality does not matter. It is true that a regular business is not made of selling this ice for domestic purposes, but it is a fact, however, that when an occasional piece of ice is required the local butcher is the one who furnishes it. In this way a considerable quantity of exceedingly filthy ice is marketed for domestic use.

Below are given a few notes on the sources of the ice supply for the cities and principal villages:

Of the larger cities nearly every one has one or more artificial ice plants, supplying both the local trade and shipping also to the neighboring towns.

Bellefontaine has a small artificial ice plant which supplies a portion of the local trade. Natural ice is shipped in from Lake Erie and cut locally from Silver Lake and a few small ponds.

Dayton is supplied with both artificial and natural ice. The Dayton Ice and Cold Storage Company has a plant which turns out about 90 tons daily during the season from May to October. The bulk of this is used in Dayton, but some is shipped to Hamilton, Miamisburg, Piqua, Troy, Xenia, and a number of smaller places. Three of the local breweries have each an artificial ice plant of from 30 to 35 tons capacity daily, a large portion of the product of which is used for general local consumption. The natural ice is cut by several companies from ponds fed from Mad, Stillwater and the Great Miami rivers.

In Eaton the Crystal Ice Company has an artificial ice plant of eight tons daily capacity. Nearly all of this is used locally; a small quantity is shipped to West Alexandria.

Nearly all the ice supply for Hamilton is made by a local brewery, which ships some out to surrounding villages. Some natural ice is cut from a basin fed by the hydraulic canal, which is in turn fed by the Great Miami River.

Lebanon is supplied with about five tons daily from a local artificial ice plant. A small amount of natural ice is cut from Turtle Creek and some is shipped in from Lake Erie.

Middletown has a local brewery equipped with an ice plant of 60 tons daily capacity. Natural ice is cut from ponds fed from the Miami and Erie canal.

In Springfield the Springfield Coal and Ice Company made, during the past year, 6,237 tons of artificial ice. The greater part of this was used locally, the remainder being shipped to Bellefontaine, Troy, etc. Natural ice is brought in from Lake Erie and from the Dayton ponds by five dealers.

The Urbana Ice Company supplies Urbana with ten tons daily, of artificial ice, practically all that is used in the city. Some natural ice is cut from local ponds, but its use is not extensive.

Piqua formerly had an artificial ice plant which supplied much of the ice used for domestic purposes both locally and for the neighboring towns, but this burnt during the last season and this city was compelled to use ice from the hydraulic and its basins, helped out with artificial ice shipped in from Dayton.

The cities and villages near Cincinnati, as Cleves, Evanston, Hyde Park, Madisonville, Norwood, Oakley, Pleasant Ridge, etc., are furnished with ice from the varied supply for this large city. Much of the ice used for domestic purposes is manufactured, though there is still an enormous quantity cut from the Miami and Erie canal and its basins and from ponds fed from this waterway.

Batavia, Blanchester, Bradford, Greenville, Oxford, St. Paris, Troy, West Alexandria, and Xenia are supplied partly with natural ice from local ponds and streams and partly with artificial ice from the plants at Cincinnati, Dayton, Eaton, Hamilton, Hillsboro and Urbana.

The remaining cities and villages of the Miami watershed are supplied almost entirely with natural ice from the various local sources. Practically all the ice used by the following villages is cut from local ponds fed from surface drainage: Ansonia, Arcanum, Bethel, Brookville, Camden, Jackson Center, Lewisburg, Mason, Milford, Mt. Washington, New Carlisle, New Vienna, South Charleston, Spring Valley, Versailles, Waynesfield, Wilmington, West Milton, and a host of smaller villages.

In the following list there are included the principal towns which depend almost entirely upon ice cut from the local creeks and rivers, usually from the back-water of some dam: Belle Center, Cedarville, DeGraff, Germantown, Jamestown, Loveland, Morrow, Osborn, Pleasant Hill, Quincy, Sidney, Waynesville, Williamsburg, West Carrollton, and Yellow Springs, also including, of course, the large number of small villages supplied in this way.

A few, including Covington, Franklin, Lynchburg, West Liberty, Tippecanoe City, etc., are supplied both from ponds and from flowing streams.

Lake View and its neighboring villages cut a considerable quantity of ice from the Lewistown reservoir.

Miamisburg is supplied with ice from ponds filled from the canal.

Near Le Sourdsville, in Butler county, there are a number of large ponds, supplied with water from the canal, from which formerly an enormous amount of ice was cut and shipped and from which there is still taken a considerable quantity.

VI. PUBLIC WATER SUPPLIES.

In the Miami watersheds there are 30 cities and villages which are supplied with water from 28 water-works. Cincinnati, Hyde Park, and Evanston, portions of which are within the watershed, are furnished with Ohio River water by Cincinnati works, which plant is outside of the watershed and will not be included in the discussion of the supplies themselves. Only a portion also of the population of Norwood is within the watershed, but this city is furnished with its own public supply from a source within the watershed.

There is within the watershed, in cities and villages supplied with water, a total population of 242,762, of which 238,243 are classed as urban. There are six villages, Osborn, Trotwood, West Alexandria, West Carrollton, Lynchburg, and Waynesville, with a total population of 4,519, which have water-works, but are not classed as urban as each has a population of less than 1,000. Of these Trotwood, with a population of 214, is the smallest; in fact this village is the smallest in the state to be so provided. The first four named villages are in the Great Miami watershed and the remaining two belong to the Little Miami.

Of the urban towns not supplied with water there are ten, with a total population of 16,314 in the Great Miami; and eight, with a total population of 11,885 in the Little Miami watershed, making a total of eighteen, with a population of 28,199. Two of these eighteen, Miamisburgh and Wilmington, have populations of 3,941 and 3,613 respectively, and are sadly in need of a public water supply. It is impossible, with conditions as they exist in Ohio, for villages of this size to obtain a potable water from the average private well. As a general rule it is very difficult to obtain a satisfactory water from the private wells of any of the urban towns, and they would all be benefited by the installation of a good public water-works.

The percentage of urban towns without water supplies, in these watersheds, is larger than for any of the other districts which have been investigated. In the Great Miami there is a total of 26 towns classed as urban, only 16 of which have water-works, while the Little Miami has only eight provided with water out of a total of 16, or in both the watersheds there are only 24 water supplies in 42 towns. No doubt much of this slowness to take up public improvements is due to the fact that a large number of the citizens of these villages are retired farmers, who have come in to live at ease on very moderate incomes. It is a class who have lived nearly their whole lives without the conveniences of a modern community and no desire is felt for them, especially as their installation adds materially to the tax rate at first.

The commercial and industrial elements are nearly always for the improvement of the village and where these predominate there is

usually no trouble in securing votes. It usually requires a severe fire or an especially fatal epidemic of some water-borne disease before many of these communities see the need of a public water supply.

As stated in the last annual report, and repeated here in the hope of dispelling the doubts of some hesitating community; there has been invented no method of carrying off the wastes of the human economy which is as sanitary, unobjectionable and cheap as the water-carrying system, and no public improvement will do so much for the prosperity of a village and for the health of its people as the introduction of a good potable water supply in connection with a complete sanitary system of sewers.

CLASSIFICATION.

For convenience in studying the public water supplies they have been divided with reference to source into the usual classes: Surface and Ground. The "Ground" division is further subdivided into Sub-surface and Deep-seated waters, according to the character of the same, as explained by the terms. As has been stated this division is not always easy to make, but it is the intention to keep in the first class all waters the purity of which is easily influenced by surface pollution, and to place in the latter class those supplies which are drawn from such depths or through such strata that the surface conditions have but little if any influence.

According to the above divisions the following table has been prepared.

TABLE VII — CLASSIFICATION OF PUBLIC WATER SUPPLIES.

Classes.		Towns.	Population. Totals	
(A) Surface.....		{ 1—Batavia	1,029	
		{ 2—Piqua	12,172	
		Total		13,201
		Average		6,600
(B) Ground.....	Subsurface.	{ 1—Dayton	85,333	
		{ 2—Eaton	3,155	
		{ 3—Franklin	2,724	
		{ 4—Greenville	5,501	
		{ 5—Hamilton	23,914	
		{ 6—Lynchburg	907	
		{ 7—Middletown	9,215	
		{ 8—Osborn	948	
		{ 9—Oxford	2,009	
		{ 10—Tippecanoe City..	1,703	
		{ 11—Trotwood	214	
		{ 12—Troy	5,881	
		{ 13—Urbana	6,808	
		{ 14—Versailles	1,478	
		{ 15—Waynesville	723	
		{ 16—West Carrollton..	987	
		Total		177,500
		Average		10,719
	Deepseated	{ 1—Bellefontaine	6,649	
		{ 2—Lebanon	2,867	
		{ 3—Madisonville	3,140	
		{ 4—Norwood	6,480	
		{ 5—Sidney	5,688	
		{ 6—West Alexandria..	740	
		Total		25,564
		Average		4,264
		Total		177,064
		Average		8,048
(C) Surface and Ground	{ Surface and Subsurface	{ 1—Blanchester	1,788	
		{ 2—Springfield	38,253	
		{ 3—Xenia	8,696	
		Total		48,737
		Average		16,246
		Grand total..		239,002
		General average.....		8,852

This table brings out, even better than in any of the other watersheds studied, that there are but few streams left in the state that can furnish a potable water supply.

In the Miami watersheds there are but two towns supplied wholly with surface water. One of these supplies, Batavia, is filtered before using, and the other, Piqua, is not fit for domestic use and is not used

for such purpose by any of the citizens of that city, and if the present financial troubles of Piqua are straightened out, the city will soon be supplying its citizens with a sub-surface water which has already been developed, thus leaving only one supply entirely from surface sources.

In the Surface and Ground division there are three towns supplied with surface and sub-surface water. Blanchester obtains such a large percentage of its supply from an impounding reservoir that its ground water is lost sight of and the whole is rendered unfit for domestic use from the poor quality of the surface water.

Springfield does not actually belong in this class and would not now be in it but for two dry years which cut down its excellent ground supply to such an extent as to compel it to go to Buck Creek in order to tide over several short days and to secure a reserve for fire protection. Ordinary years, or with a further development of the ground supply, this city would belong to the "sub-surface" class.

The original supply of Xenia was obtained by impounding the runoff from several springs together with some surface water. This has since been supplemented by a ground water which is as yet used only during the dry season when the reservoir runs low.

Sidney's first supply was entirely from surface sources, but these have long been abandoned for a deep-seated water.

In the above list of 27 supplies, only one, that of Batavia, appears to be permanently from a surface source and that only because a filtration plant has been installed. Three, Piqua, Sidney and Xenia, are now, or were originally, supplied practically with surface water and have or intend to replace it with ground water, or are in a transitory state. Two, Blanchester and Springfield, have been compelled to supplement ground water with surface water from lack of a sufficient amount of the former. Of these 27 supplies, 22 are entirely from ground sources.

The total population supplied either wholly or in part with surface water, is 61,938, of which 50,425 are furnished with it as a temporary expedient only, or the ground supply is under way. The remaining 11,513, or 5 percent of the grand total, are for the present to be supplied with surface water.

The 22 ground supplies are for a population of 177,064, or 74 percent of the total population in the towns with public water supplies. Of these ground water supplies 16 of the 22, with a total population of 171,500, are of sub-surface origin and the remaining six, with a population of 25,564, are of deep-seated origin.

Dayton, population 85,333, is one of the largest cities in the United States which is supplied entirely by ground water. With the exception of Lynchburg and possibly Versailles, all the ground water supplies may be considered as satisfactory so far as potability is concerned. The sub-surface supply for Urbana is taken from a point in a direct line with the under drainage from the city, and it may in time suffer some deterioration though at present it is entirely potable.

A few of the ground waters are slightly objectionable from the presence of iron, and many are too hard for an ideal water, but neither of these objections is fatal to their use for a public supply, especially in this state where it is the rule to collect rain water in cisterns for the laundry, bath, etc.

DETAILED DESCRIPTION OF PLANTS.

Following are the detailed descriptions of the public water supplies of the two watersheds, except for the towns of Eaton, Greenville, Piqua, Sidney, Springfield and Urbana. The water-works for the first five of these are fully described in the annual report of the State Board of Health for 1898, and that for Urbana in a special report in the annual report for 1900. However, a brief description will be given here of these supplies, with special reference to changes in supply and increase of mains, services, etc.

Batavia. Population 1,029. The public water supply was put in by the village in 1900, at a cost of \$31,000, including the electric light plant. The supply is obtained from the East Branch of the Little Miami River at a point just above the village and above all local pollution. As seen from the description of the watershed the East Branch drains a hilly farming country, and receives no especial pollution until Lynchburg, 42 miles above, is reached; at which place a large distillery winters some 1,000 head of cattle, the filth from which enters the stream direct. Before this source was approved filtration was required by the Board. The village presented plans for a rather crude system of slow sand filtration which were here hardly satisfactory and finally plans for mechanical filtration by the We-fu-go process, this latter being approved. The water is pumped from the river by a low service pump to two sedimentation tanks situated on the side hill back of the filter house and pumping station. From these tanks the water flows by gravity onto the filter, through it to a clear water well, from which it is pumped to a supply reservoir situated on the high ground north of the village.

The filtration process involves the use of a coagulant, sulphate of aluminum, in this case, which is admitted to the water as the latter passes to the sedimentation basins. The coagulant solution is pumped from the coagulant tanks by a small piston pump actuated by the low service pumps so that a constant ratio is maintained between the amount of solution and the amount of water pumped. The actual amount of coagulant used must be varied by changing the strength of the solution; it is usually one grain per gallon. At times of high turbidity in the stream it will be necessary to increase this amount in order to get perfect clarification.

The sedimentation tanks are two in number and consist of open wooden tubs, each 20 feet in diameter and $13\frac{1}{2}$ feet high, with an effective height of 10 feet, giving a capacity of 23,660 gallons each or 47,320

gallons for both. These tanks are exposed to the weather, with no protection whatever. As the water enters the tanks it falls over the sides of a pan secured to the discharge pipe of the pump and receives more or less aeration. The tanks are used alternately, an automatic device admitting the water to first one and then the other, thus securing a longer period of quiet sedimentation. The outlet from these tanks is supplied with a skimmer float so as at all times to secure the clearest water for the filters. The tanks are supplied with suitable pipes for flushing out the collected sediment.

The filter consists of an 8-foot cypress tank, 8 feet deep, fitted with a double bottom, the upper one of which is fitted with brass strainers supplied with phosphor bronze screens. The openings in the screens are approximately $\frac{3}{4}$ by $\frac{1}{100}$ inches. In the bottom of the strainer is placed a brass ball so arranged as to throttle the downward flow but to allow a free upward flow of the wash water. On the screens rest a two foot nine inch bed of sand, composed of crushed quartz. The compartment between the bottoms is for the collection of the clear water and to this is connected the discharge pipe of the filter which is fitted with a regulator so that the rate of filtration is kept uniform, irrespective of the condition of the bed. The inlet pipe is controlled by means of a float, so that a uniform level is maintained on the bed. A positive head of 4 feet is maintained on the filter and a suction head of seven feet, making a total of eleven feet.

The filter is washed by reversing the flow through the sand and at the same time stirring it with a revolving mechanical agitator. The wash water is carried off by an annular trough fastened inside of the filter tank.

The total filtering area is 50 square feet, or 0.0012 of an acre, giving, at the standard capacity of 120,000,000 gallons per day a rate of filtration of 100,000,000 gallons per acre per day.

The clear well is 42 feet in diameter and 16 feet deep, with a capacity of 165,000 gallons.

The low service pump is a horizontal duplex McGowan of 500,000 gallons capacity. The water is pumped from the clear well to the reservoir by two horizontal duplex McGowan pumps of 750,000 gallons capacity each. The pressure at the station is 95 pounds, and the average on the mains is somewhat less than this. The reservoir is 30 feet in diameter and 17 feet deep, with a capacity of 84,000 gallons. Both this reservoir and the clear well have brick walls laid in cement and concrete bottoms and neither is covered.

There are 3.5 miles of mains in, to which some 90 percent of the people have access. There are 26 services in all, of which all are in use and none metered. As the plant has been running for so short a time no estimate can be made on the average daily consumption. The water after filtration is clear and seems to be of excellent quality and should displace the private wells, many of which are badly contaminated.

Bellefontaine. Population 6,649. The public water supply was put in by the village in 1882, and has cost to date \$140,000. The water is obtained from four 8-inch wells located just south of the village in the valley of a small stream. The wells are 160 feet deep and go through 80 feet of gravel and clay and 80 feet into limestone. The supply has always been sufficient, but it is intended to put down a number of shallow wells in the gravel for an additional supply. There is no local pollution of the grounds and it is a question, even if there were, whether it would affect the deep wells.

The water is pumped direct from the wells to a reservoir by two horizontal compound duplex Gordon pumps of 750,000 gallons capacity each. A new vertical compound duplex Snow pump of 2,500,000 gallons capacity is to be installed soon, for reserve in case of accident to the present pumps. The reservoir is located on high ground to the east of the village and gives a pressure of 80 pounds at the station and an average of 60 pounds over town. It is an open basin 206 by 106 by 20, holding 2,000,000 gallons, with sloping sides built of brick laid in cement. The whole is surrounded by a high barbed-wire fence for protection from contamination.

There are 17.0 miles of mains in, to which some 95 percent of the people have access. There are 956 services in, of which 900 are in use and only 18 metered. It is intended to increase the number of meters very soon so as to cut down waste, as the consumption is very large for a village of this size. The average daily consumption is 642,000 gallons, which is 714 gallons per service, 143 per consumer, and 94 per capita of the total population.

Blanchester. Population 1,788. The public water supply was put in by the village in 1896, and has cost to date \$30,000. An electric light plant costing \$10,000 is in the same building. The supply was to be obtained from 3 wells 6 feet in diameter and 50 feet deep, but they soon failed and the village was without water, as there were no funds available for a new supply. In 1899 a private company was formed among the citizens of the village for the purpose of securing a supply of water for fire protection at least. A franchise was obtained from the village under which they were to supply the water, the village to pump the same, and the company to have the privilege of collecting the private water rents.

As ground water was not available and there were no streams near of sufficient size to secure a supply, a reservoir was excavated in the valley of a small run, having a drainage area of 1,400 acres, and a surface supply impounded. The reservoir has an area of about 3 acres and an average depth of 6 feet, giving a capacity when full of some 5,000,000 gallons. The reservoir was formed by excavating the upper end and by an embankment around the lower portion. The sides and bottom are not paved or protected in any way, and the water is very muddy for a long period after each rain. In the spring of 1900 a heavy rain caused a flood, too large

for the waste-way, and the reservoir banks were overflowed and a portion broken out. The waste-way is 10 feet long and can flow 5 feet deep before the reservoir banks will overflow. This would require a rainfall of $\frac{1}{4}$ inch per hour over the entire watershed, of such duration as would allow the water from the most remote section to reach the river; it would also have to be on a soil, impervious from continual rain or freezing. The reservoir with connections, etc., cost \$6,000.

The water from the reservoir flows by gravity through an 8-inch pipe to the old wells in which the suction of the pumps is placed. The water in the wells will rise to within 7 feet of the surface when pumping is suspended for some time and the reservoir line will not flow until the wells have been lowered to 12 feet so that a small amount of well water is supplied, but it is a very small proportion of the total consumption and can hardly be considered.

The water is pumped direct from the suction wells to an elevated tank by two horizontal compound duplex McGowan pumps of 750,000 gallons capacity each. The pressure is 50 pounds at the station and averages 45 pounds on the mains.

There are 11 miles of mains in, to which 90 percent of the people have access. There are 70 services in, all of which are in use and 10 metered. The average daily consumption is about 15,000 gallons, which is 214 gallons per service, 43 gallons per consumer, and 9 gallons per capita of the village.

The water is not used for domestic purposes at all and is not fit for such use without filtration.

Dayton. Population 85,333. The public water supply was put in by the city in 1869 and cost to January 1, 1900, \$1,363,282, for construction alone. The total expenditure of the water-works department for the thirty years was \$2,108,721, of which \$745,429 was for maintenance. The total income for the same period was \$1,248,638, showing the net cost of the plant to be \$860,083, a figure much below the present value of the works. The construction account for 1900 will be heavy as a new suction line is being put down, also new wells, and a large pump is to be put in requiring extensive changes in pumping station, etc.

The first supply was from Mad River direct, but this was abandoned in 1887, when the first of the present extensive system of wells were put down. There are now eighty-seven 8-inch wells; driven 30 to 60 feet in the bed of Mad River in the upper portion of the city. During the past year 24 of the old wells were replaced and 20 additional new ones put in, bringing the total to the figure named above.

The bed of Mad River consists of a very porous gravel which carries a large amount of water, the sub-surface flow of the stream. The normal level of the water in the wells coincides with the river level except in very low stages when it rises above the surface water level. On a test one well gave 400 gallons per minute with the level lowered only 5 feet. At

this same test a well 50 feet away was lowered only 4 inches. The wells extend up and down the river 2,000 feet each way from the pumping station and until this year were reached by a 30-inch suction line going down the river and by a 20-inch and 30-inch going up. A new 5 foot suction line is being put in up the river to replace the small lines and also, in time, to extend above them as new wells are added.

While the site of the wells is above all sewage pollution it does not escape all manufacturing refuse, especially that from a strawboard works. Except in times of extreme low water it is doubtful whether any of this refuse would influence the sub-surface water, but at such dry times some of it would soak into the gravel bed, where, if the filtration were not perfect it would pollute the water of the wells. This is a phase of the question which must be watched in the future. It may be advisable at no distant time to put in a sewer or conduit that would care for all the objectionable drainage to the river above the wells.

The water is pumped direct to the mains by a 4,000,000 quadruplex Holly pump installed in 1873, a 10,000,000 gallon horizontal, compound, duplex Holly pump erected in 1889, and a 15,000,000, gallon pump of the same pattern, installed in 1895. A new 10,000,000 gallon vertical, triple expansion Holly is now being put in.

The domestic pressure averages 60 pounds. There are 117.9 miles of mains in, giving some 90 percent of the total population access to the water. There are 12,018 services in, of which 9,500 are in use and 563 of these metered, about 60 are for hydraulic elevators.

The average daily consumption is 5,098,000 gallons, which is 537 gallons per service, 98 per consumer, and 60 per capita of the total population.

The water is of excellent quality and is in general use to the gradual exclusion of private wells.

Eaton. Population 3,155. A detailed description of the public water supply for this village was given in the report of the State Board of Health for 1898, and there has been no change in the source since that time. There are now 417 services in, of which 407 are in use and 168 of these are metered. The average daily consumption is 58.800 gallons, which is 144 gallons per service, 29 per consumer, and 19 per capita of the village. A comparison with the report for 1898 will show that the estimate of the consumption was much too high; the present figure is from the pumping records for the year. The low consumption is due to the absence of manufacturing plants and also to the total lack of sewers. There are about 30 water-closets supplied by the system, the waste water going to cesspools.

Franklin. Population 2,724. The public water supply for this place was put in by the village in 1887, and has cost to date \$57,000. The supply is obtained from six 6-inch wells driven 65 feet into a clay, sand, and gravel bed bordering the Miami and Erie canal in the lower part of

the village. The water stands, normally, 22 feet below the surface and is lowered but little by the ordinary consumption. There is direct connection with the canal for use in cases of emergency.

The water is pumped direct from the wells to the mains by two horizontal, compound, duplex Holly pumps of 750,000 gallons capacity each. The pumps are set 18 feet below the surface so as to keep the water well within the suction limit. The station pressure carried is 60 pounds and the average on the mains is 55 pounds.

There are 8.0 miles of mains in, giving some 90 percent of the people access to the water. There are 410 services in, of which 340 are in use and 24 of these are metered. The average daily consumption is estimated at 300,000 gallons, which is 882 gallons per service, 172 per consumer, and 110 per capita of the total population. The large consumption is due to the extensive use of the water by the various paper mills. Some of it is also due to the large amount of leakage claimed to be caused by the deterioration of the pipes from electrolysis.

Greenville. Population 5,501. Since the supply for this village was reported on, in 1898, there have been added six new 8-inch wells, averaging in depth from 46 to 54 feet. These go through various layers of clay and gravel down nearly to bed-rock. These wells are in the same location as the old ones and were put down merely as a safeguard against the failure of the first set. This, together with the running of a large number of services to the curb on account of street paving, has run the total cost up to \$101,000.

There are now 717 services in, of which 450 are in use and 257 of these metered. The average daily consumption is 218,000 gallons, which is 484 per service, 97 per consumer, and 40 per capita of the whole population.

Hamilton. Population 23,919. The public water supply was put in by the city in 1884 and has cost to date \$365,000. The first supply was from a large well or basin situated in the low land north of the city, and lying between the Great Miami River and an abandoned channel of the same stream. The basin was 500 feet long, 100 feet wide, and 15 feet deep, dug into a large bed of gravel.

The supply from this source was unsatisfactory and in 1889 a number of deep wells were driven in the basin and these, with additions, have furnished the supply since that time. Now there are nineteen 6-inch and three 8-inch wells, driven from 75 to 135 feet into the bed of gravel.

The water flows from the wells at the river level and is conducted about 1,000 feet to a receiving basin set 13 feet below mean low water in the river. The receiving well is a closed brick chamber 28 by 13 by 33 feet deep, with a capacity of 90,000 gallons.

The water is pumped from this basin to a supply reservoir by a vertical, compound, duplex, Gordon-Maxwell pump of 3,000,000 gallons

capacity. The average domestic pressure is 90 pounds. The reservoir is situated on the high ground west of the Great Miami River, and is reached by two mains, a 20-inch main laid in the bed of the river, and a 10-inch main crossing on a bridge. It is an open basin with sides paved with brick in cement, and is 200 by 270 by 24 feet deep, with a capacity of 7,000,000 gallons. As first constructed the reservoir was not cemented and there was frequent trouble with growths of various kinds. Since the sides were cemented, however, no trouble has been reported.

There are 40 miles of mains in, giving some 95 percent of the population access to the water. The mains even extend outside of the corporation in order to supply several manufacturing plants. There are 3,295 services in use and 827 of these metered. The average daily consumption is 1,818,000 gallons, which is 569 gallons per service, 103 per consumer, and 76 per capita of the total population. It will be noted here that the pumping capacity is less than twice the average daily consumption, a rather perilous condition for a pumping plant to be in notwithstanding the very fair reservoir capacity.

Lebanon. Population 2,867. The public water supply was put in by the village in 1896, and has cost to date \$52,000. A light plant has recently been installed in the same building, at a cost of \$20,000 completed. The supply is obtained from six 6-inch wells driven from 96 to 104 feet through alternating strata of clay, sand, and gravel. The wells are located a short distance west of the village in the low ground bordering a small tributary to Turtle Creek.

The water from the wells is siphoned to a receiving well from which it is pumped to a standpipe by two horizontal, compound, duplex, Stillwell-Bierce and Smith-Vaile pumps of 750,000 gallons capacity each. The supply from the wells is such that the water in the receiving well can be lowered only 10 feet by the present pumping capacity.

The receiving well consists of a brick cistern covered with a tin roof and is 40 feet in diameter and 25 feet deep, with a capacity of 235,000 gallons. The standpipe is 80 feet high and 25 feet in diameter, with a capacity of 300,000 gallons. The average pressure on the mains is 70 pounds.

There are 10 miles of mains in, to which at least 95 percent of the people have access. There are 442 services in, of which 430 are in use and 12 of these metered. Two of the meters are on the lines to the County Infirmary and Children's Home, respectively.

The average daily consumption is 105,000 gallons, or 244 gallons per service, 49 per consumer, and 37 per capita of the total population. The water seems to be of excellent quality and is in general use for domestic purposes.

Lynchburg. Population 907. The public water supply was put in by the village in 1896, and has cost to date, together with an electric light plant, \$18,000. The first supply was obtained from a dug well 16

feet in diameter and 20 feet deep, which enters a bed of gravel just above the rock. This well soon failed to supply enough water and a 4-inch suction line was run to a large basin from which a distillery obtains its water supply. This basin consists of a trench 120 feet long by 15 feet wide, with an 18-foot well at each end, all excavated 15 feet deep in a bed of sand and gravel. The sides of this basin are planked up and the whole is covered with a flat plank roof at the ground level. It occupies a low swale and is easily accessible to surface drainage, much of which is very objectionable. The well is situated nearly in the center of the village and its water is more or less polluted by objectionable surface drainage. In 1900 the 4-inch suction line to the distillery basin was replaced by a 5-inch line.

As the distillery opens for the season in November and will use practically all of the water available from the basin, the village was compelled to seek a new supply. Application was made to the State Board of Health for the approval of three springs, only one of which could be considered, namely, the "Sulphur" spring, located one and one-fourth miles northeast of the village in the low land near a small run. With suitable care this spring ought to be able to provide at least 20,000 gallons of potable water per day, and its use was approved by the Board.

It is at such a height that the water could be conducted by gravity to a pump well at the present station.

The water is pumped from the well and basin to an elevated tank by a horizontal, duplex, Laidlaw-Dunn-Gordon pump of 250,000 gallons capacity. The tank is 16 feet in diameter, 20 feet high, with a capacity of 30,000 gallons, and is placed on a trestle 89 feet high. The average pressure on the mains is 40 pounds.

There are 3.5 miles of mains in use, to which 80 percent of the people have access. There are 104 services in, of which 94 are in use and none metered. The average daily consumption is estimated at 25,000 gallons, which is 266 gallons per service, 53 gallons per consumer, and 28 per capita of the total population. The water is not in general use for domestic purposes.

Madisonville. Population 3,140. The public water supply was put in by the village in 1892 and has cost to date, together with an electric light plant, \$66,500. The water-works cost alone about \$35,000. The supply is from one 6-inch well and two 8-inch wells, each 150 feet deep and drilled through various strata of clay, quicksand and gravel down to the rock. The wells are located just west of the village in the low valley of a branch of Duck Creek. The normal level of the water is 21 feet from the surface.

At first the wells were pumped by direct suction, but this method failed to supply enough water and in 1895 three deep well pumps were put in. The wells are only 12 feet apart and within the walls of the pumping station, conditions favorable to the installation of deep well

pumps. All the pumps are the double acting Laidlaw-Dunn-Gordon type, two having a capacity of 500,000 gallons each, and the third 350,000 gallons. The pump cylinders are placed 120 feet from the surface.

The water is pumped by the deep well pumps to a receiving tank and from this direct to the mains by two horizontal, compound, duplex, Laidlaw-Dunn-Gordon pumps of 1,000,000 gallons capacity each. The receiving chamber consists of a covered steel tank 20 feet in diameter and 15 feet high, with a capacity of 55,000 gallons. The pressure at the station is 80 pounds and the average on the mains is 50 pounds.

There are nine miles of mains in, giving some 90 percent of the people access to the water. There are 188 services in, of which 96 are constantly in use and 83 in use during sprinkling season only. The average daily consumption is estimated to be 110,000 gallons, or 800 per service, using the average number in use, 160 gallons per consumer, and 35 per capita of the total population. The water seems to be of excellent quality and is in general use for domestic purposes, where it is available.

Middletown. Population 9,215. The public water supply was put in by the city in 1874, and has cost to date \$110,000. The supply is obtained from a large well 20 feet in diameter and 35 feet deep, dug in a gravel bed in the upper part of the city and near the Great Miami River. The normal level of the water is 16 feet below the surface and it is lowered about 11 feet by ordinary consumption in the dry season. The supply has always been sufficient except in 1893, when it failed during a period of exceptionally dry weather.

The water is pumped direct from the well to the mains by a quadruplex Holly power pump, installed in 1874. The pump has a capacity of 1,250,000 gallons per day and is operated by a 56-inch American turbine operating under a 17-foot head of water, secured from the Middletown hydraulic.

In 1885 two horizontal, compound, duplex, Smith-Vaile steam pumps of 1,500,000 gallons capacity each were installed. These are for reserve and for use in case of fires, steam being kept at low pressure in one boiler all the time. In cases of emergency the water from the hydraulic can be admitted to the well.

Enough water power to supply the domestic pressure is obtained from the hydraulic at an annual rental of \$260, certainly a very economical method of pumping. A pressure of 45 pounds is maintained at the station and the average on the mains is 40 pounds.

There are 18.0 miles of mains in, to which some 75 percent of the people have access. There are 1,095 services in, of which 995 are in use and 62 of these are metered. The average daily consumption is 900,000 gallons, or 904 gallons per service, 180 per consumer, and 98 per capita of the total population. The large consumption is due to some extent to the general use of the water for industrial purposes; also to an extensive waste, induced by the cheap water and fostered by the small number of meters.

The water from the well seems to be of excellent quality and the authorities are trying to prevent its pollution by regulating the construction of vaults in the upper part of the city in the general vicinity of the well.

Norwood. Population 6,480. This village is on the divide between Duck Creek and Mill Creek, and only about half of its population is tributary to the former, or the Little Miami watershed.

The public water supply was put in by the village in 1894, and has cost to date \$154,138. A light plant was installed in the same building, costing, completed, \$34,501. The original supply was from six drilled wells, 235 feet deep and 6 and 8 inches in diameter. These wells began to fail and two 10-inch wells were drilled 260 feet deep through clay, gravel, and sand and into the limestone rock a few feet, which have furnished the whole supply since September 1st, 1900. The normal level of the water is 110 feet from the surface and it is lowered but little by pumping. The wells are located in the eastern part of the village, but the water will not be greatly liable to pollution on account of the depth at which it is found, 240 feet, and the general introduction of sewers which has prevented the construction of vaults. A third well is being put down so as to have an ample supply.

The water is pumped to a receiving basin by air-lifts and from there to a standpipe by two horizontal, compound, duplex, Laidlaw-Dunn-Gordon pumps of 750,000 gallon capacity each. Compressed air is supplied by a Rand Drill Company's compressor and by a new Ingersoll-Sergeant compressor, the former being held in reserve. A 3-inch air line is carried down 240 feet in the well and the water is forced up between this and the casing.

The receiving basin is an open oval-shaped cistern, 15 by 20 by 8 feet deep, with a capacity of 14,000 gallons. The standpipe is 60 feet high, 40 feet in diameter, with a capacity of 537,000 gallons, and is placed on a hill of such height that the station pressure is 112 pounds, standpipe full, and the pressure on the mains varies from 104 to 142 pounds.

There are 35 miles of mains in, giving some 95 per cent of the people access to the water. There are 974 services in, of which 874 are in use, and 140 of these metered. Owing to the changes in the plant the consumption could not even be estimated.

Osborn. Population 948. The public water supply was put in by the village in 1895, and has cost to date, including the electric light plant, \$30,000. The supply is obtained from four 6-inch wells in the northern part of the village. The wells are driven 50 feet through a thin stratum of clay and into a large bed of gravel. The normal level of the water is from 15 to 18 feet below the surface and it is lowered but little by pumping.

The water is pumped direct from the wells to a stand-pipe by a horizontal, compound, duplex, Laidlaw-Dunn-Gordon pump of 500,000 gal-

lons capacity. The standpipe is 10 feet in diameter, 125 feet high, and has a capacity of 70,000 gallons. The station pressure is 60 pounds and the average on the mains is 50.

There are 3.0 miles of mains in, to which some 80 percent of the people have access. There are 100 services in, of which 97 are in use and none metered. The average daily consumption could not be obtained.

The water seems to be of good quality but it is not in general use as yet for domestic purposes.

Oxford. Population 2,009. The public water supply was put in by the village in 1896, and has cost about \$45,000. The supply is obtained from a large well dug in the sand and gravel bed near Four Mile Creek, some distance northeast of the village. The well is 20 feet in diameter, 35 feet deep, and is walled up with brick laid in cement and arched over so as to prevent flooding during high water, which overflows the well site. The top of the well is provided with a ventilator above high water. The normal level of the water is 9 feet from the surface but it is frequently lowered to 24 feet by pumping.

The water is pumped direct from the well to the mains by two horizontal, compound, duplex, Smith-Vaile and Stillwell-Bierce pumps of 750,000 gallons capacity each. The pressure on the mains varies from 45 to 65 pounds.

There are 7.0 miles of mains in, which give some 95 percent of the people access to the water. There are 234 services in, of which 211 are in use and 9 of these metered. The daily average consumption is 30,000 gallons, which is 142 gallons per service, and 15 per capita of the village. The total number of consumers is hard to estimate owing to the fact that 3 quite large institutions are supplied, but the consumption per consumer cannot be far from 25 gallons.

Piqua. Population 12,172. As yet there has been no change in the water supply for this city since the 1898 Report of the State Board of Health, though the water-works trustees have developed a ground supply which secured the approval of the Board, but owing to local jealousies and difficulties this water has not been substituted for that of the "Hydraulic."

The trustees put down twenty-three 4-inch wells in the bed of the Great Miami River north of the city and in the valley of the Ross Creek adjoining. These wells were from 48 to 134 feet deep, driven through various strata of soil, clay, gravel and sand. A good flow of water was found in 14 of the wells and these were reserved for the public supply. While there are certain local conditions which might interfere with the continued purity of the water, yet they are so unimportant and so easily overcome that the well supply should be installed at once as it is so vastly superior to the water from the hydraulic.

The secretary of the water works, Mr. W. B. Mitchell, has given in his last report, figures on the original cost of the plant and hydraulic and the cost of additions:

Original cost of hydraulic.....	\$268,911 64
Original cost of water-works.....	56,896 84
Total	<hr/> \$325,808 48
Additional cost of water-works.....	63,896 84
Total cost of plant complete to May 1, 1900.....	<hr/> \$389,705 32

In addition to the above the new wells cost \$2,861.71, all of which came from the revenue of the plant. The total cost of operating the plant, maintenance of hydraulic, etc., exclusive of interest was \$5,144.32 for the past year.

There are now 24.5 miles of mains in, giving some 90 percent of the people access to the water. There are 1,400 services in, of which 1,320 are in use and none metered. The average daily consumption is estimated at 1,500,000 gallons which is 1,136 gallons per service, 227 per consumer, and 123 per capita of the total population. This large consumption is due to the general industrial use of the water and to the excessive wastage, brought on by no meters and a poor quality of water.

Sidney. Population 5,688. There has been no change in the supply for this city since our report of 1898.

At this time there are 14.5 miles of mains in, giving 95 percent access to the water. There are 800 services in, of which 700 are in use and 24 of these metered. The average daily consumption is 639,000 gallons, which is 913 gallons per service, 183 gallons per consumer, and 112 gallons per capita of the city's population. The consumption will soon increase as it is intended to put in a complete sanitary sewer system, thus increasing the number of houses supplied with closets, baths, etc.

Springfield. Population 38,253. Since our report of 1898 this city has had considerable trouble from a partial failure of the supply of water from the large well and gallery. On account of the extremely dry weather of 1899 it was necessary to help out with water from the wells and galleries of the old station, the former source of the total supply. The water from this source was pumped, by the old engine left at the station, to the reservoir near the new station and allowed to flow from there to the pump well. Even this increase in the supply was not sufficient for all purposes and Springfield was left in very bad shape for fire protection.

To overcome this danger the trustees, in the early part of the summer of 1900, tapped the old 20-inch main leading from the old station to the reservoir at Buck Creek and put in a 12-inch pipe, so that the creek water can flow direct to the reservoir. The intention was to keep the reservoir full in this way and to allow the water to seep through into the gallery and pump well and only use the water direct in case of fire. This reservoir is 250 by 500 by 15 feet deep and as it is excavated in a rather porous

gravel bed, nominally its water level is equal to and varies with the height of the ground water.

It was the intention to reinforce the ground water with seepage from this reservoir supplied from the creek, and such use would not be objectionable, but as the reservoir puddled very soon with turbid creek water this seepage action was necessarily slow and it was necessary on a few occasions to run the creek water direct to the pump well, by the way of the reservoir and a 36-incl. pipe from the latter to the pump well.

There are local difficulties, as well as sanitary, regarding the use of Buck Creek water, in the nature of suits for diverting the water from the mills below, etc.

There are now 54 miles of mains in use, giving some 90 percent of the people access to the water. There are 4,090 services in, of which 4,040 are in use and 200 of these metered. The average daily consumption is 3,070,000 gallons, which is 760 gallons per service, 138 per consumer, and 80 per capita of the total population.

Tippecanoe City. Population 1,703. The public water supply was put in by the village in 1897, and has cost to date, together with the electric light plant \$28,000. The supply is obtained from driven wells located in the eastern part of the village and near the Miami and Erie canal. There are five 8-inch wells, driven 80 feet deep into a deep bed of sand and gravel. Only three of the wells are in use. The normal level of the water is 10 feet below the surface and this is lowered by pumping to a depth of from 17 to 35 feet, according to the season.

The wells are surrounded by the scattered houses of a small village, and will in time suffer some pollution unless steps are taken to drain off all objectionable refuse.

The water is pumped direct from the wells to the mains by two horizontal, duplex, Smith-Vaile pumps of 500,000 gallons capacity each, and at a pressure of 60 pounds, which is decreased to 55 on most of the mains.

There are 6.0 miles of mains in, which gives some 95 percent of the population access to the water. There are 267 services in, all of which are in use, but none metered. The average daily consumption is 75,000 gallons, which is 281 gallons per service, 56 per consumer, and 44 per capita of the total population. A canvass was recently made of this village and it was found that there are 428 houses in the place, 315 of which are supplied with water by the 267 services. From the census, this is four persons per house, using which figure, there are 1260 people using the water, or by allowing five persons per service there are 1,335, a discrepancy of 6 percent, which is certainly allowable in estimates of this character.

Trotwood. Population 214. This is the smallest village, or rather community as it is not incorporated, in the state that has a public water supply. The plant was put in in 1899 by a stock company, formed of nearly all the citizens, to provide primarily for a fire protection only,

and has cost to date \$3,100. The agitation was occasioned by a very disastrous fire the year previous.

The water supply is secured from two 8-inch wells, driven 26 feet through clay and hard-pan and into a bed of gravel. The water stands in the wells 12 feet below the surface and the level was lowered but little by pumping at the rate of 120 gallons per minute. The water is pumped direct from the wells to a horizontal steel tank by a vertical, duplex, power pump run by a gasoline engine. The tank, engine, pump, and wells are all within the confines of a neat stone building situated at the edge of the village.

The pump was made by C. O. Lucas of Greenville, Ohio, and is fitted with a device by which a certain amount of air can be pumped with the water to the tank and there, under pressure, force the water through the mains when the pump is not running. The pump is a double acting one, with a capacity of 175,000 gallons in 24 hours, working under a pressure of from 40 to 80 pounds, the limits allowed in the tank. This tank is 24 feet long, 5 feet in diameter and holds 5,000 gallons. It is fitted with a blow-off cock for the regulation of the pressure and the amount of air above the water.

There are 1,800 feet of mains into which some 75 percent of the people have access. There are 22 services in, 16 of which are for sprinkling only, and none metered.

The water is of good quality but it is not in general use for domestic purposes as yet. On account of the few services and the wide range of pressure allowed in the tank, from 80 to 40 pounds, the pump is run for a short time only, each day, and the water in the tank is not so fresh as it would be with a larger consumption.

Troy. Population 5,881. The public water supply was put in by the village in 1884, and has cost to date \$125,000. The first supply was obtained from a large well, 25 feet in diameter and 31 feet deep, dug in the sand and gravel which underlies this whole section. This failed to supply the increasing consumption and in 1891 another large well was dug, which was later filled by a flood and not reopened. As the consumption increased, five 8-inch wells were driven 20 feet in the bottom of the first large well and the flow considerably increased for a time, but the water soon ran low and they are not of much use now. In 1898 three wells were driven near the old large wells but they were of no value. In the same year five 8-inch wells were driven along the street south of the plant and considerable water found at from 38 to 51 feet below the surface. In 1899 eight 8-inch wells were driven just east of the plant, to a depth of from 38 to 54 feet. The last two sets of wells, 13 in all, furnish the bulk of the water.

The water is pumped direct from the wells by two horizontal, compound, duplex, Laidlaw-Dunn-Gordon pumps of 1,700,000 gallons capacity each. Until March 1898 nearly all of the water was pumped by

two Smith-Vaile power pumps of 1,000,000 gallons capacity each, actuated by a 15-inch and 28-inch Victor turbine supplied with water under 16 feet 8 inch head from the hydraulic. This hydraulic was fed from the Miami and Erie canal and a little local territory and furnished an excellent power until March 1898, when a flood washed out the embankment near the power house, damaging the latter and filling up one of the wells as noted above. The average domestic pressure carried is 60 pounds.

There are 14.0 miles of mains in, to which some 90 percent of the people have access. There are 1,002 services in, of which 994 are in use and 78 of these metered. The average daily consumption is 503,000 gallons, which is 506 gallons per service, 101 gallons per consumer, and 86 per capita of the total population.

The water works is located in the northern part of the city where the wells are subject to but little local pollution as yet and the water seems to be of good quality.

Urbana. Population 6,808. There has been no change in the water supply for this city since the special report of the State Board of Health in the 1899 annual report, except in the increased use of the driven wells. These eight wells are 6 inches in diameter, average 40 feet in depth, and obtain their water from an extensive bed of gravel mixed with fine sand. The sand finally worked into the screens of the wells to such an extent that the supply from this source was lessened materially. To overcome this the well casings were drawn and new screens put down and the wells put in use to help out the large dug well.

There are now 20.0 miles of mains in, giving some 85 percent of the people access to the water. There are 960 services in, of which 900 are in use and 18 of these metered. The average daily consumption is 1,170,000 gallons, which is 1,286 gallons per service, 257 per consumer, and 186 per capita of the total population.

The water is at the present time a potable one, but it is in the line of pollution from the sub-surface drainage of the city and it may at some time seriously feel the influence of this drainage, though it is not harmed to any extent by it as yet.

Versailles. Population 1,478. On November 1, 1900, this village secured the approval of the State Board of Health for a public water supply to be obtained from three 8-inch wells located on the banks of Swamp Creek and near the center of the village, though not in the immediate neighborhood of many houses. The wells are driven 30 feet deep through a bed of clay and into gravel, and could furnish an excellent water but for the surrounding population. The water is not of the best but as it is all that can be had, and is so much better than the private well water, its use was permitted. The plant is now being put in and it is expected to be in operation very soon.

Waynesville. Population 723. On November 1, 1900, this village secured the approval of the State Board of Health for a public water supply to be obtained from a number of 6-inch drilled wells located south of the village and near the Little Miami River. The wells are from 40 to 50 feet deep, drilled through various strata of sand and gravel and into limestone, just above which the water is found.

The wells are removed from practically all local pollution and the small amount existing can easily be removed, so that they should furnish an excellent water, much better than the private well supply. Bonds for \$30,000 have been sold and a combined electric light and water plant is now being put in.

West Alexandria. Population 740. The public water supply was put in by the village in 1897, and has cost to date \$16,000. The supply is obtained from four artesian wells located in the southwestern part of the village. The wells are 6 inches in diameter, two of them 132 feet deep, one 95 feet deep, and one 65 feet deep, and all go through alternate layers of clay, gravel, and hard-pan. It is claimed that the wells will flow with a head of 16 feet above the surface.

Only the natural flow of the wells is utilized, the water being conducted to a receiving basin from which it is pumped to the standpipe by two horizontal, duplex, Smith-Vaile pumps of 1,000,000 gallons capacity each. The basin consists of a covered brick well, 20 feet in diameter, 24 feet deep, with a capacity of 7,500 gallons. The standpipe consists of a steel tank 40 feet high, 16 feet in diameter, and holding 60,000 gallons, placed on a brick tower 60 feet high. The average pressure on the mains is 40 pounds.

There are 2.5 miles of mains in, to which 95 percent of the people have access. There are 91 services in, all of which are in use, and all metered. The average daily consumption is estimated to be 35,000 gallons, which is 385 gallons per service, 77 gallons per consumer, and 47 gallons per capita of the village's population. This consumption, if correct, is very large for a place of this size, especially with all services metered, and it is hardly accountable for unless it is due to the rather excessive summer sprinkling.

West Carrollton. Population 987. The public water supply was put in by the village in 1895 and has cost to date \$7,900. The supply is obtained from two 8-inch wells drilled in the low land along the Miami and Erie canal. The wells are 65 feet deep and go through gravel, hardpan, and into a deep bed of sand in which the water is found. The normal level of the water is about 10 feet from the surface and it is lowered to about 30 feet by the highest consumption.

The water is pumped direct to the mains by a horizontal, duplex, McGowan pump of 750,000 gallons capacity. The average pressure is 60 pounds. The pump is located in the mill of the G. H. Friend Paper and Tablet Company, which firm has a ten-year contract with the village

under which they are to furnish steam for the pump and keep the same in repair for the use of same and of the water in the wells. The consumption of water in the village is small, but a large amount is used by the paper mill.

There are 2.5 miles of mains in, giving some 90 percent of the people access to the water. There are 89 services in, of which 84 are in use and none metered. The well water seems to be of good quality and is used for domestic purposes wherever available.

Xenia. Population 8,696. The public water supply was put in by a private company in 1887 and has cost to date, as claimed, \$200,000. The company now operates under the name of "The Xenia Water Company."

The first supply was obtained by impounding the runoff of a number of springs, located one and one-half miles north of the city. The flow from these is collected in an open reservoir, formed by an earthen embankment, with sheet-piling core-wall, thrown across a small valley and forming a basin one and one-half acres in area. Through the center of the reservoir there is a dividing wall, for convenience in cleaning only. This, as well as the inner side of the dam, is roughly paved. Much of the surface drainage to the reservoir is diverted but some of it is used. Later, near this reservoir, a large well, 75 feet square, was dug 25 feet deep through a bed of clay and hardpan into gravel. The water from this is pumped by a 1,000,000 gallon horizontal, duplex, Worthington pump, to a large stone pump-well, 40 feet in diameter, built in the dividing wall of the reservoir. The combined water of the well and reservoir is then pumped through the mains to a standpipe by two horizontal, compound, duplex, Gordon-Maxwell pumps of 1,500,000 gallons capacity each. It is estimated that the springs will supply 300,000 gallons daily and the well 100,000.

In 1896 these sources were helped out by an additional ground supply secured from six 6-inch wells and three 8-inch, located southwest of the city, just out of the corporation limits. These wells are from 28 to 40 feet deep and go through a bed of clay and into gravel. The normal level of the water is six to eight feet from the surface and it can easily be lowered to the suction limit, indicating a rather weak vein at the above depths. A test well is now being put down into the rock, which is found at 60 feet, in hopes of securing a more abundant supply.

This last set of wells is pumped by a 1,000,000 gallon horizontal compound, duplex, Deane pump, direct to the mains and standpipe. This station supplies some 175,000 gallons a day for a few days each week in the summer and fall, and is not used in the winter.

The standpipe is 115 feet high by 20 feet in diameter, with a capacity of 270,000 gallons, and furnishes, when full, an average pressure on the mains of 55 pounds.

There are 20 miles of mains in, to which some 90 percent of the people have access. There are 700 services in, of which 670 are in use

and 50 of these metered. The average daily consumption is 350,000 gallons, which is 522 gallons per service, 134 per consumer, and 42 per capita of the total population.

SUMMARY.

The data in the previous section have been summarized in Table VIII:

The above table contains a brief description of the 27 public water supplies of the Miami watersheds.

The total population in these cities and villages is 239,000, or an average of 8,852 per supply. Twenty-three of the plants are under municipal ownership and control, one under joint municipal and private control, and three are owned and controlled by private corporations.

The first water-works for Blanchester was put in by the village, but the supply of water from wells failed almost immediately and the village was without water for nearly two years, as there were no more funds available to seek a new supply.

In order to get fire protection a private company was formed and a franchise secured from the village according to which the company agreed to furnish a supply of water for the pumps in return for which they were to collect all the private water rents. This company, the Blanchester Water and Light Company, put in the impounding reservoir at a cost of \$6,000. The franchise is to run for 15 years from 1899, and the village can purchase at the expiration of the franchise only. The water rates are fixed by the franchise, which also specifies that the water shall be taken from the reservoir.

The Trotwood water-works was put in by a stock company formed of citizens of the village. This company has no franchise as the village is not incorporated and none could be granted. The plant was put in by sufferance alone. The mains are in the county and township roads, the verbal permit of the commissioners and trustees having been secured.

The franchise of the Urbana water-works company expired in 1899 and no new one has been secured since that time. There has been considerable friction between the city and the company and the terms of settlement are uncertain. The company still supplies water for the citizens, collecting the rent for the same, and this condition may hold for some time.

Xenia is supplied with water by the Xenia Water Company, operating under a 20 years' franchise granted July 19, 1886. The city may purchase the plant at any time after the expiration of the first ten years. Rates are fixed by the franchise. The water is to be taken from wells or filtering galleries near the Little Miami River or Caesar's Creek, with direct connection to either stream for fire protection only. As a matter of fact neither stream is used, but the water is secured from an entirely foreign source.

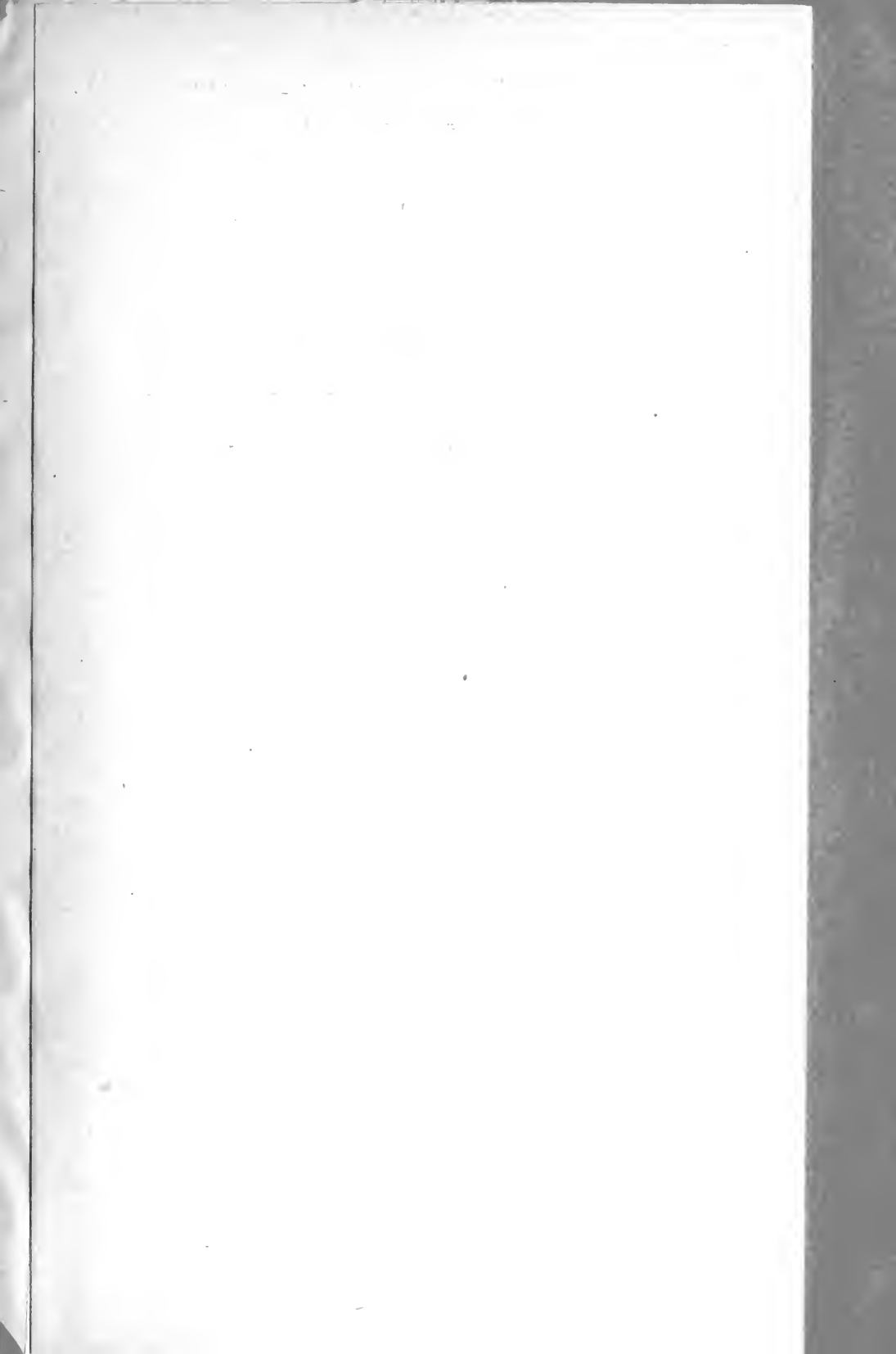


TABLE VIII.—DESCRIPTION OF PUBLIC WATER SUPPLIES.

Number.	Name of Town.	Population.	Ownership of Plant.	Date of Installation.	Cost to Date.	For Capital Cost.	Source of Supply.	Method of Water Supplying.	Capacity of Reservoir or Standpipe.	Pressure on Mains.	Miles of Mains.	Percent of Population accessible to Mains.	Number of Streets in.	Number of Services in use.	Number of Meters in use.	Pumps.	Total Pumping Capacity in gallons per 24 hours.	Average Daily Consumption in gallons.	Average Daily Consumption per Service.	Average Daily Consumption per Consumer.	Average Daily Consumption per Capita.	Remarks.
1	Batavia	1,029	Village	1890	21,000	20.41	Branch of Little Miami River, Filtered	Pump to Reservoir	Res., 25,000, clear well 150,000	90	3.5	50	20	20	0	3 Hor. comp. duplcs Mc-Gowan, 750,000 gals each	1,500,000	Not obtainable				Water 1 high 1 plate
2	Bell's Springs	9,849	Village	1882	140,000	21.06	12 wells, 160 ft. deep	Pump to Reservoir	2,000,000	60	17.0	95	900	800	18	2 Hor. comp. duplcs Gordon, 750,000 gals each	1,500,000	642,000	711	111	9	
3	Black River	1,388	Village & Private	1880	30,000	29.14	Standing Reservoir, 2 wells, 20 ft. deep	Pump to Standpipe	Res., 7,500,000, standpipe, 20,000	45	11.0	80	70	70	10	2 Hor. comp. duplcs Mc-Gowan, 750,000 gals each	1,500,000	15,000	211	11	11	Reservoir for reserve put in by private company
4	Dayton	85,433	City	1869	1,363,282	15.98	100 ft. wells, 30 to 60 ft. deep, bed of Mad River	Pumping Direct		60	117.9	50	12,018	9,500	5,631	1 Hor. comp. duplcs Holly, 15,000,000 1 Hor. comp. duplcs Holly, 10,000,000 1 Quadruplex Holly, 4,000,000	29,000,000	5,000,000	537	98	60	
5	Dayton	85,433	Village	1891	80,000	25.35	100 ft. wells, 74 to 89 ft. deep	Pump to Standpipe	Collecting basin, 150,000 standpipe, 150,000	55	8.7	90	475	407	168	2 Hor. comp. duplcs Gordon, 1,000,000 gals each 1 Hor. duplcs, 500,000	2,500,000	50,000	114	23	14	
6	Dayton	85,433	Village	1887	57,000	29.95	100 ft. wells, 63 ft. deep	Pumping Direct		55	8.0	90	450	400	14	2 Hor. comp. duplcs Holly, 750,000 gals each	1,500,000	600,000	552	172	110	
7	Dayton	85,433	Village	1893	101,000	18.36	100 ft. wells, 50 to 57 ft. deep 100 ft. wells, 46 to 54 ft. deep	Pump to Standpipe	141,000	50	13.0	90	715	450	257	2 Hor. comp. duplcs Hughes, 1,500,000 gals each	3,000,000	25,000	154	97	90	
8	Dayton	85,433	City	1884	92,000	15.27	100 ft. wells, 75 to 135 ft. deep 100 ft. wells, 75 to 135 ft. deep	Pump to Reservoir	Reservoir, 7,000,000 pump well, 90,000	80	10.0	95	3,205	3,145	827	1 Vert. comp. duplcs Cape & Maxwell, 4,000,000 gals each	4,000,000	1,345,000	500	101	76	
9	Dayton	85,433	Village	1886	52,000	18.11	100 ft. wells, 80 to 104 ft. deep	Pump to Standpipe	Standpipe, 300,000, pump well, 275,000	70	10.0	95	442	400	12	2 Hor. comp. duplcs Smith-Vale & Sullivan-Brown, 2,000,000 gals each	1,500,000	105,000	241	19	17	
10	Dayton	85,433	Village	1886	12,000	13.73	100 ft. wells, 0 ft. deep and 100 ft. wells, 150 ft. deep	Pump to Standpipe	30,000	40	1.5	80	104	94	0	1 Hor. duplcs Lullwater-Dunn, 2,000,000 gals each	2,000,000	25,000	205	55	28	Water not high enough
11	Dayton	85,433	Village	1892	75,000	11.14	100 ft. wells, 150 ft. deep	Pumping Direct	Receiving tank, 55,000	50	3.0	90	140	138	1	1 Hor. comp. duplcs Lullwater-Dunn, 1,000,000 gals each	1,000,000	110,000	800	100	15	Water not high enough
12	Dayton	85,433	City	1884	110,000	11.91	100 ft. wells, 45 ft. deep	Pumping Direct		10	18.0	75	1,095	995	62	1 Holly Quadruplex, 1,500,000 2 Hor. comp. duplcs Smith-Vale, 1,500,000 gals each	4,500,000	400,000	904	180	98	
13	Dayton	85,433	Village	1893	154,120	21.09	75 ft. wells, 260 ft. deep	Pump to Standpipe	Standpipe, 547,000, Res., 11,000	130	31.0	95	974	974	140	2 Hor. comp. duplcs Lullwater-Dunn, 2,500,000 gals each	5,000,000	Not obtainable				Water not high enough
14	Dayton	85,433	Village	1895	22,000	22.95	100 ft. wells, 50 ft. deep	Pump to Standpipe	70,000	50	0.0	80	100	97	0	1 Hor. comp. duplcs Lullwater-Dunn, 2,000,000 gals each	2,000,000	Not obtainable				Water not high enough
15	Dayton	85,433	Village	1898	45,000	22	120 ft. wells, 45 ft. deep	Pumping Direct		50	7.0	95	274	211	0	2 Hor. comp. duplcs Smith-Vale & Sullivan-Brown, 750,000 gals each	1,500,000	30,000	142	25	15	
16	Dayton	85,433	City	1876	389,700	8.00	Hydraulic fed from Miami and Erie Canal	Pumping Direct		21	24.5	90	1,400	1,320	0	1 Gordon Maxwell, 1,500,000 gals each 1 Gordon Maxwell, 1,500,000 gals each 1 Gordon Maxwell, 1,500,000 gals each	3,500,000	1,500,000	1,130	227	128	Water not high enough
17	Dayton	85,433	City	1874	157,500	27.00	100 ft. wells, 130 ft. deep	Pump to Standpipe	90,000	65	11.5	95	800	700	24	2 Vert. comp. duplcs Gordon, 1,500,000 gals each	3,000,000	630,000	913	183	112	Original plant not used
18	Springfield	38,253	City	1881	625,184	15.00	100 ft. wells, supplemented with Buck Creek water	Pump to Standpipe	Reservoir, 5,000,000, standpipe, 702,000	60	54.0	90	1,000	4,000	300	1 Vert. comp. duplcs Alton, 2,000,000 1 Hor. comp. duplcs Holly, 2,000,000 2 Hor. comp. duplcs Cape-Maxwell, 2,500,000	13,500,000	3,070,000	750	150	80	*In old station
19	Upper Merion	1,701	Village	1897	20,000	11.71	50 ft. wells, 80 ft. deep	Pumping Direct		55	0.0	95	267	267	0	2 Hor. comp. duplcs Smith-Vale, 500,000 gals each	1,000,000	75,000	281	56	11	Water and light, \$25,000
20	Trotwood	214	Private	1869	4,000	11.18	20 ft. wells, 20 ft. deep	Pump to Tank	5,000	60	0.4	75	22	22	0	1 Vert. duplcs Lucas, 175,000 gals	175,000	Not obtainable				10 services for sprinkling only
21	Troy	5,801	Village	1884	125,000	21.75	100 ft. wells, 31 ft. deep, 100 ft. wells, 38 to 54 ft. deep	Pumping Direct		60	14.0	90	1,002	904	78	1 Hor. comp. duplcs Lullwater-Dunn, 2,000,000 gals each	3,000,000	503,000	506	101	86	
22	Urbana	6,800	Private	1878	165,000	21.21	1 well, 20 ft. dia., 30 ft. deep, 6-in. wells, 35 to 50 ft. deep	Pumping Direct	Reservoir, 2,000,000	50	30.0	85	960	910	50	1 Hor. comp. duplcs Holly, 2,000,000 gals 1 Quadruplex Holly, 1,500,000	3,500,000	1,150,000	1,280	257	146	
23	Versailles	1,478	Village	1890			14-in. wells, 30 ft. deep															New supply Works under construction
24	Waynesville	729	Village	1890			6-in. wells, 50 ft. deep															New supply Works under construction
25	West Alexandria	749	Village	1897			14-in. wells, 65 to 132 ft. deep	Pump to Standpipe	Pump well, 7,300, standpipe, 60,000	40	2.5	95	91	91	91	2 Hor. comp. duplcs Smith-Vale, 1,000,000 gals each	2,000,000	35,000	384	77	17	
26	West Carrollton	987	Village	1895	7,900	4.00	2 8-in. wells, 65 ft. deep	Pumping Direct		60	2.5	90	89	81	0	1 Hor. duplcs Mc-Gowan, 750,000 gals	750,000	Not obtainable				
27	Xenia	8,696	Private	1887	200,000	23.00	Impounded spring and surface water 1 well, 75 ft. sq., 25 ft. deep 6-in. wells, 40 to 28 ft. deep 3-in. wells, 40 to 28 ft. deep	Pump to Standpipe	270,000	55	20.0	90	700	670	90	2 Hor. comp. duplcs Gordon Maxwell, 1,500,000 gals 1 Hor. comp. duplcs Worthington, 1,000,000 gals 1 Hor. comp. duplcs Deane, 1,000,000 gals	3,500,000	350,000	522	134	42	
Totals		239,002	25 Public 1 Private 3 Private		4,302,895			10 Direct 12 to Standpipe and 3 to Reservoir		463.0	30.423	26,925	7,632				91,875,000	350,000	522	134	42	
Averages		8,852		1889	174,112	10.32				58	18.5	89.4	1,247	1,073	306		3,673,000	833,000	581	116	67	

The very recent growth of the public sentiment in favor of water works is shown by the fact that the average age of the plants is only 11 years. Only one plant was installed during the decade from 1860 to 1870; four from 1870 to 1880, six from 1880 to 1890, and sixteen since 1890.

The total cost of the 25 plants which have been completed is \$4,352,805, or an average of \$174,112 per plant. In order to give a better idea of the relative cost of these plants, the per capita cost was computed; that is, the total cost of the water-works plant complete for every inhabitant of the city, or village. This was found to run from \$8 to \$32.02, with an average of \$19.32.

The low cost of the West Carrollton plant is due to several causes, among which are the ease with which water was secured, small amount of mains, and the absence of a standpipe or reservoir and of a pump house.

The high cost of the Piqua plant is due to the fact that a long hydraulic was constructed to furnish both water and power for the water works and power for outside industries.

The high cost for Sidney was brought about by the abandonment of the old surface supply and the installation of a ground supply.

With these exceptions the per capita cost lies within very reasonable limits, the variations being easily explained by the character of the water works and the greater or less difficulty in securing a supply.

As would be expected from the topography of these watersheds pressure is supplied by direct pumping in ten cases, by pumping to standpipes and tanks in twelve cases, and by pumping to reservoirs in three cases only. There are no gravity supplies. Compressed air instead of elevation furnishes the pressure in the case of the Trotwood tank.

The average size of the standpipes and tanks is 211,667 gallons. The three supply reservoirs have a capacity of 98,000, 2,000,000,000 and 7,000,000 gallons respectively. There are ten reserve and impounding reservoirs, collecting wells, ranging in size from 55,000 gallons to 7,500,000 gallons.

The average pressure at which the water is supplied varies from 24 to 120 pounds per square inch, with an average of 58 pounds. Sixty pounds seem to be the standard domestic pressure and most of the variations below this figure are due to irregular topography and to too small mains.

In all, there are 463.0 miles of water mains in, an average of 18.5 for each water-works.

The percent of population accessible to the mains runs from 75 to 95, the average being 89.4. The percentage of the total population of all the towns which is accessible to the mains is 90.2, a little greater than the average percent, as the larger cities and villages usually have more complete systems. The total number of services that have been put in is

30,467, or 1,219 for each plant. Of these the total number in use is 26,866, an average of 1,075 per system.

There are in all 7,652 meters in use, or an average of 306 for each water-works, or 425 for each water-works that has any meters whatsoever. Seven of the supplies do not have a metered service. West Alexandria has every service metered. This village together with Dayton, Eaton, Greenville, Hamilton and Norwood, constitute all the supplies in which meters are at all extensively used.

The total pumping capacity of the 25 water-works is 91,825,000 gallons per 24 hours, or an average of 3,673,000 gallons for each. It is interesting to note that the total pumping capacity of the several supplies varies from 1.6 times the average daily consumption to 57 times. For the 20 in which the consumption could be estimated the average excess of the total pumping capacity over the average daily consumption is fourteen-fold. This high figure is due to the large excess found in the new plants, as an allowance for future growth. It would seem that for a direct pumping plant, with no, or moderate storage facilities, the total pumping capacity should be at least four to six times the average daily consumption and in more than one unit, so as to allow for short periods of excessive consumption and for accidents. Urbana, Bellefontaine, and Piqua each have a total pumping capacity only a little more than two times the average daily consumption; and Hamilton has only 1.6 times as much. Hamilton has a supply reservoir nearly seven times its average daily consumption, and Bellefontaine one of three times its average daily consumption, so that in these cases the deficiency is not felt so severely. Bellefontaine is now increasing its capacity by a new 2,500,000 gallon pump, and Hamilton has the matter under way.

Both the Urbana and Piqua plants would be seriously handicapped by an accident to one of their pumps, or by a large fire occurring at the time of the maximum consumption.

The average daily consumption for the 20 plants where this was obtainable is 833,090. The average daily consumption per service is 584 gallons; per capita of the total population, 67 gallons; and per consumer it is 116 gallons. There are not enough metered supplies to bring out the reduction in consumption due to these devices.

RATES.

The rates at which water is sold for general domestic purposes, together with the meter rates, in the 25 cities and villages having public water-works in operation, is given in detail in Table IX.

It is almost impossible to make a comparison of the cost of water for ordinary uses in the different places, owing to the variation in the way in which the charges are made. For ordinary house use, that is, one yard hydrant or one inside faucet, the charge is based, in the various towns, according to the number of rooms, number of faucets, number of persons, and finally with no specifications whatever.

TABLE IX—WATER RATES

Number	Place	Ownership	House occupied by One Family and Supplied by One Meter	Flat Rates										Remarks	Meter Rates								Remarks	Spectrum Meter Company's estimate of rate				
				Each Additional Room	Each Additional Family	Each Additional Basement	One Bath Tub, Hot and Cold	Each Additional Tub	One Water Closet	Each Additional Closet	One Wash Basin	Sprinkling	Private Stables, One Horse and Cattle Washing		Each Additional Horse	Rates per 1000 gallons for consumption in gallons per day of the following amounts												
																100 to 200	201 to 1,000	1,001 to 2,000	2,001 to 3,000	3,001 to 4,000	4,001 to 5,000	5,001 to 6,000			6,001 to 7,000	7,001 and over		
1	Batavia	Public	6 rooms or less, \$2.50	\$.50	\$2.50		\$2.00		\$2.00		\$.50	Lawn, 60 ft. front or less, \$5.00 Each additional foot front, \$1.00 Street with water use free		\$2.00	\$1.00												Meter rate not determined yet	\$11.00
2	Bellfontaine	Public	6 rooms or less, \$1.00	\$.50	\$1.00		\$2.00	\$1.00	\$2.00	\$1.00		1/2 foot front, or less, 25 feet deep, \$1.00 Each additional foot front, \$1.00 Each additional square yard back of 25 feet, \$1.00		\$1.00	50	Minimum rate, \$1.00		\$.15	\$.15	\$.10	\$.08	\$.05	\$.03	\$.01	\$.01	Min. charge, \$10.00 for 12-inch meter, \$15.00 for 18-inch meter	\$10.00	
	Blanchester	Private	6 rooms or less, \$4.00		\$1.00		\$1.50		\$2.00	\$1.00		Lawn with other use, 60 feet front, \$2.50 Each additional foot front, \$2.50 Street, 50 feet front or less, \$1.00 Each additional foot front, \$1.00		\$1.00	\$1.00			\$.04	\$.25	\$.22	\$.20	\$.15	\$.15	\$.15			\$10.00	
14	Brooklyn	Public	6 rooms or less, \$4.00	\$.50	\$4.00	\$1.00	\$2.00	\$1.00	\$2.50	\$1.00	\$2.00	Street, 25 ft. front or less, \$1.00 Each additional foot front, \$1.00 Yard, 25 ft. front or less, \$1.00 Each add. ft. 25 ft. deep, \$1.00 Each additional square yard, \$1.00		\$2.50	\$1.00	Minimum rate, \$4.00	\$.08	\$.08	\$.06	\$.05	\$.04	\$.03	\$.02	\$.01	\$.01	Annual rent, \$2.00; min. charge, \$1.20 for 12-inch and smaller meters, 12-inch meter, \$10.00	\$12.00	
	Easton	Public		\$1.00		\$1.00	\$2.00	\$1.00	\$2.50	\$1.00	\$.50	Lawn and street, 50 feet front or less, \$1.00 Each additional foot front, \$1.00	For 2 animals, or less, \$1.00	50 for third animal	Minimum rate, \$1.00	\$.20	\$.18	\$.15	\$.12	\$.10	\$.08	\$.06	\$.04	\$.02	\$.01	Min. charge, \$7.00	\$15.00	
6	Franklin	Public	\$1.00		\$1.00		\$1.00		\$2.00		\$1.00	Street and lawn, 100 feet front or less, \$1.00 Each additional foot front, \$1.00		\$2.00	50	Minimum rate, \$1.00	\$.15	\$.12	\$.10	\$.08	\$.06	\$.04	\$.02	\$.01	\$.01	Min. rate per year, \$12.00	\$16.50	
	Greenville	Public	7 persons or less, \$4.00 Each add. person, \$1.25		\$1.00		\$1.00	\$1.00	\$2.00	\$1.00		Lawn and street, 60 ft. front or less, \$1.00 Yard, 25 ft. front or less, \$1.00 Each additional foot front, \$1.00		\$1.50	\$1.00	Minimum rate, \$1.00	\$.10	\$.10	\$.10	\$.10	\$.10	\$.10	\$.10	\$.10	\$.10	1/2 inch meter, \$5.00; 1 inch meter, \$10.00; 1 1/2 inch meter, \$12.00	\$12.00	
	Hammond	Public	6 rooms or less, \$5.00	\$.50		\$1.00	\$2.00	\$2.50	\$2.00			Lawn with other use, 50 feet front or less, \$1.00 Each additional foot front, \$1.00 Street, 50 ft. front or less, \$1.00 Each additional foot front, \$1.00		\$2.00	\$2.00 each above two	Minimum rate, \$2.00	\$.10	\$.15	\$.11	\$.08	\$.07	\$.06	\$.05	\$.04	1/2 inch meter, \$10.00; 1 inch meter, \$12.00; 1 1/2 inch meter, \$15.00; 2 inch meter, \$18.00	\$16.50		
13	Hampton	Public	4 rooms or less, \$5.00	\$.25		\$2.00		\$1.50		\$1.00		Street, 50 feet front or less, \$1.00 Each additional foot front, \$1.00 Yard, 200 sq. ft. of lawn, \$2.00 Each additional foot front, \$1.00 Each add. 1000 sq. ft. lawn, \$1.00	For 2 animals, or less, \$1.00	50 each above two	Minimum rate, \$1.00	\$.25	\$.20	\$.15	\$.10	\$.08	\$.06	\$.04	\$.02			\$12.00		
10	Lynchburg	Public	\$4.00			\$1.00						Lawn and street, 60 ft. front or less, \$1.00 Each additional foot front, \$1.00	2 horses, or less, \$1.00	25 each above three	Minimum rate, \$2.50	\$.20	\$.08	\$.07	\$.06	\$.05	\$.04	\$.03	\$.02					
11	Madsenville	Public	4 rooms or less, \$4.00	\$.50	\$1.00		\$2.00	\$2.50	\$1.00	\$1.00		Street, 50 feet front or less, \$1.00 Each additional foot front, \$1.00 Lawn, 50 feet front, 150 feet deep, \$1.00 Each additional foot front, \$1.00		\$2.50	\$1.00		\$.40	\$.20	\$.15	\$.10	\$.08	\$.06	\$.04	\$.02			\$20.00	
12	Middletown	Public	4 rooms or less, \$3.00	\$.25		\$1.50	\$2.50	\$2.00	\$2.50	\$1.00		Lawn and street, 50 ft. front or less, \$1.00 Each additional foot front, \$1.00 Above 50 ft. each additional, \$1.00		\$2.00	\$1.00		\$.07	\$.07	\$.07	\$.07	\$.07	\$.07	\$.07	\$.07	\$.07	1/2 inch meter, \$10.00; 1 inch meter, \$12.00; 1 1/2 inch meter, \$15.00; 2 inch meter, \$18.00	\$12.00	
15	Newport	Public	4 rooms or less, \$4.00	\$.50	\$1.00		\$2.00		\$2.50		\$1.00	Lawn and street, 50 ft. front or less, \$1.00 Each additional foot front, \$1.00		\$1.00	\$1.00		\$.20	\$.20	\$.20	\$.20	\$.15	\$.15	\$.15	\$.15	\$.15	1/2 inch and smaller, min. charge, \$5.00	\$12.00	
14	Osborn	Public	2 houses or less, \$5.00		\$1.00		\$2.00	\$1.00				Lawn and street, 50 ft. front or less, \$1.00 Each additional foot front, \$1.00		\$2.00			\$.15	\$.10	\$.07	\$.05	\$.03	\$.02	\$.01	\$.01		1/2 inch meter, \$7.00; 1 inch meter, \$10.00; 1 1/2 inch meter, \$12.00; 2 inch meter, \$15.00	\$10.00	
15	Oxford	Public	\$5.00			\$1.00		\$2.00		\$1.00		Lawn and street, 50 ft. front or less, \$1.00 Each additional foot front, \$1.00	2 horses, or less, \$1.00	50 each above two	Minimum rate, \$1.00	\$.08	\$.07	\$.06	\$.05	\$.04	\$.03	\$.02	\$.01	\$.01		1/2 inch meter, \$7.00; 1 inch meter, \$10.00; 1 1/2 inch meter, \$12.00; 2 inch meter, \$15.00	\$10.00	
16	Piqua	Public	Included in other uses			\$2.00	\$1.00	\$2.00	\$1.00	\$2.00		Lawn and street, 50 ft. front or less, \$1.00 Each additional foot front, \$1.00	2 cattle, or less, \$1.00	50	Minimum rate, \$1.00												No meters in use	\$10.00
17	Snyder	Public	9 rooms or less, \$5.55	\$.55	\$1.11		\$2.22	\$1.11	\$2.22	\$1.11		Lawn and street, 40 ft. front or less, 25 feet deep, \$1.33 Each additional foot front, \$1.00 Each additional square yard, \$1.00		\$3.71		55	Minimum rate, \$4.00	\$.25	\$.25	\$.20	\$.20	\$.20	\$.20	\$.20	\$.20			\$16.05
18	Springfield	Public	6 rooms or less, \$1.15	\$.50	\$1.00		\$2.50	\$2.50	\$2.50	\$2.50	\$2.50	Lawn and street, — square yards of lawn, \$1.00 Each additional square yard, \$1.00		\$2.00	\$1.50	Minimum rate, \$4.00	\$.10	\$.10	\$.10	\$.10	\$.10	\$.10	\$.10	\$.10	\$.10	Special	Min. charge, \$10.00	\$19.00
19	Topicansville	Public	3 rooms or less, \$7.50	\$.50		\$2.00	\$1.00	\$2.50	\$1.00	\$1.50		Street, 25 ft. front or less, \$1.50 Each additional foot front, \$1.00 Lawn, 25 feet front, 150 feet deep, \$1.50 Each additional foot front, \$1.00 Each additional sq. yard, \$1.00		\$2.00	\$1.00										No meters		\$12.50	
20	Trotwood	Private	7 persons or less, \$1.00 Each add. person, \$1.25		\$1.00		\$2.00 for 2 persons, each add. person, \$1.25	\$1.00				Lawn and street, 60 ft. front or less, \$5.00 Each additional foot front, \$1.00		\$1.50	\$1.00	Minimum rate, \$1.00											No meters	
21	Troy	Public	8 rooms or less, \$1.00	\$.25		\$2.50	\$1.00	\$2.00		\$2.00		Lawn and street, 60 ft. front or less, \$5.00 Each additional foot front, \$1.00		\$3.00	50		\$.08	\$.07	\$.06	\$.06	\$.06	\$.06	\$.06	\$.06	\$.06	Min. charge, \$6.00		\$14.50
22	Urbana	Private	6 rooms or less, \$1.00	\$.50	\$4.00		\$2.50		\$3.00			Lawn and street, 50 ft. front or less, \$1.00 Each additional foot front, \$1.00 Each additional square yard, \$1.00		\$2.00	\$1.50	Minimum rate, \$1.00	\$.10	\$.20	\$.15	\$.10	\$.08	\$.06	\$.04	\$.02	\$.01			\$17.50
23	West Alexandria	Public														All services metered	\$.15	\$.15	\$.15	\$.15	\$.15	\$.15	\$.15	\$.15	\$.15	Min. charge, \$10.00		
24	West Carrollton	Public	3 rooms or less, \$4.00	\$.50	\$1.00		\$2.00	\$1.00	\$2.50	\$1.00	\$2.00	Street, 25 feet front or less, \$1.00 Each additional foot front, \$1.00 Lawn, 50 feet front or less, 25 feet deep, \$1.00 Each additional foot front, \$1.00 Each additional square yard, \$1.00		\$1.50	\$1.00	Minimum rate, \$1.00	\$.10	\$.10	\$.10	\$.10	\$.10	\$.10	\$.10	\$.10	\$.10	6-inch meter, \$10.00; 12-inch meter, \$12.00; 18-inch meter, \$15.00; min. charge, \$5.00	\$21.25	
25	Xenia	Private	6 rooms or less, \$5.75	\$.50		\$3.00	\$1.50	\$1.00	\$1.50			Lawn and street, 25 feet front or less, \$1.50 Each additional foot front, \$1.00		\$2.50	\$1.50	Minimum rate, \$5.75	\$.25	\$.25	\$.22	\$.20	\$.16	\$.12	\$.10	\$.09				\$20.75
NUMBER AVERAGE				15	15	2	24	14	21	13	14		19	19		16	21											21
AVERAGE				\$.45	\$1.40	\$1.00	\$2.22	\$1.33	\$2.34	\$1.32	\$1.32		\$2.22	\$1.07		\$3.00	\$1.10	\$.14	\$.14	\$.12	\$.11	\$.10	\$.09					\$17.30

*Date not sufficient to estimate rate.

†Average for 18 public supplies \$17.06

†Average for 3 public supplies \$16.68

The rates for bath tubs, water-closets, wash-basins, etc., are much more uniform and a very fair idea of the variation in price can be secured, but the charges for street and lawn sprinkling are made on so many different bases that comparisons are almost impossible. To overcome this difficulty a standard case has been assumed, consisting, as is shown in the table, of an 8-room house situated on a lot 50 by 100 feet, and valued at \$5,000. This house is supposed to be occupied by one family, of six persons, and to be fitted with one kitchen sink, one bath tub, one water closet, one wash-basin, and one yard hydrant for sprinkling yard and street. It also has a stable in which are kept one horse and one carriage. For this case there has been computed as carefully as possible, from the published schedule of rates, the annual charge in each city and village where the data were sufficient.

For the 21 given, the average was \$17.30 with a minimum of \$10.00 and a maximum of \$22.00. For the 18 municipal plants the average was \$17.06, and for the three private \$18.68. It will be interesting to note that for 20 cases in the Muskingum watershed the average rate for this same standard house was \$19.63 and for 13 municipal plants it was \$17.94 and for the seven private, \$22.78. Between the rates for the plants owned by the municipalities there is a remarkable agreement in the averages, while in the private rates there is quite a wide discrepancy.

Many different methods are also used in specifying the rates to be charged for metered water and it was necessary to make these conform to the standard as given in the table. On this account, in a few cases the figures are only approximations, but the general rate is believed to be correct.

For the minimum use of water the meter rate varies from 7 to 40 cents per 1,000 gallons, and for the maximum use from 3 to 20 cents per 1,000 gallons. It does not seem possible that very much attention is paid to the actual cost of supplying the water when these rates were established.

The majority of the meter rates are based on a sliding scale depending on the amount of water used, but a few charge the same price per 1,000 gallons for both the large and small consumers. It is also customary to establish a minimum charge for meters in the shape of an annual rent for the meter, or a set minimum rate which must be paid whether the water is used or not, this latter usually varying with the size of the meter.

VII. DAMS AND WATER-POWERS.

As in the Muskingum watersheds, so there has been for the Miami rivers an enormous decline in the use and development of water-power, especially among the smaller powers on the minor streams. The decline in the Little Miami watershed is only apparent in the smaller number of mills, as the horse-power in use has diminished but little owing to the more complete development of some of the larger powers, especially the one at King's Mills.

In gathering the information concerning the use and development of the water-power in the Miami watersheds, the same methods were used as were employed in the investigations of the previous year. The data are from personal inspections and from reports of owners and operators in nearly every case and can be considered reliable to a degree sufficient for work of this character. The estimates on the horse-power available are not exact owing to the uncertainty regarding the condition of the wheels. The estimates on pond area are rather crude and are given only as a guide to the amount of storage available.

The areas of tributary watersheds were obtained by planimeter measurements from the State Board of Health map of Ohio.

Owing to the large area to be gone over a number of small and little-used powers were probably overlooked. This is especially true in Logan county, where there are one or two small mills on the head-waters of both the Great Miami and Mad rivers, which were not visited on account of their unimportance and inaccessibility.

Of the dams and water-powers investigated, the principal data are given in Tables X and XI.

In the Great Miami watershed there are given 53 dams, only two of which are not in use; five divert water for the supply of the Miami and Erie canal, and 48 furnish water-power; two dams supplying both the canal and water-power. The 48 dams furnish some 89 mills, with a total horse-power of 4,158 or an average of 47 horse-power per mill. In 1880, according to the United States census, there were in the Great Miami watershed 218 mills, using some 7,191 horse-power, or 33 horse-power per mill. In the 20 years there was a decline of 59 percent in the number of mills, but only of 42 percent in the total horse-power in use.

In the Little Miami watershed the table gives 24 dams, two of which are not in use and the 22 remaining supply power for 28 mills, using 1,803 horse-power, or 64 horse-power per mill. In 1880 there were 59 mills using 1,956 horse-power, which is 33 per mill. This is a decline of 52 percent in the number of mills, but only 8 percent in the total horse-power in use.

On the Miami and Erie canal, within the Great Miami watershed, there are given 14 mills using 860 horse-power, or 61 per mill. In 1880

11111111
11111111
11111111

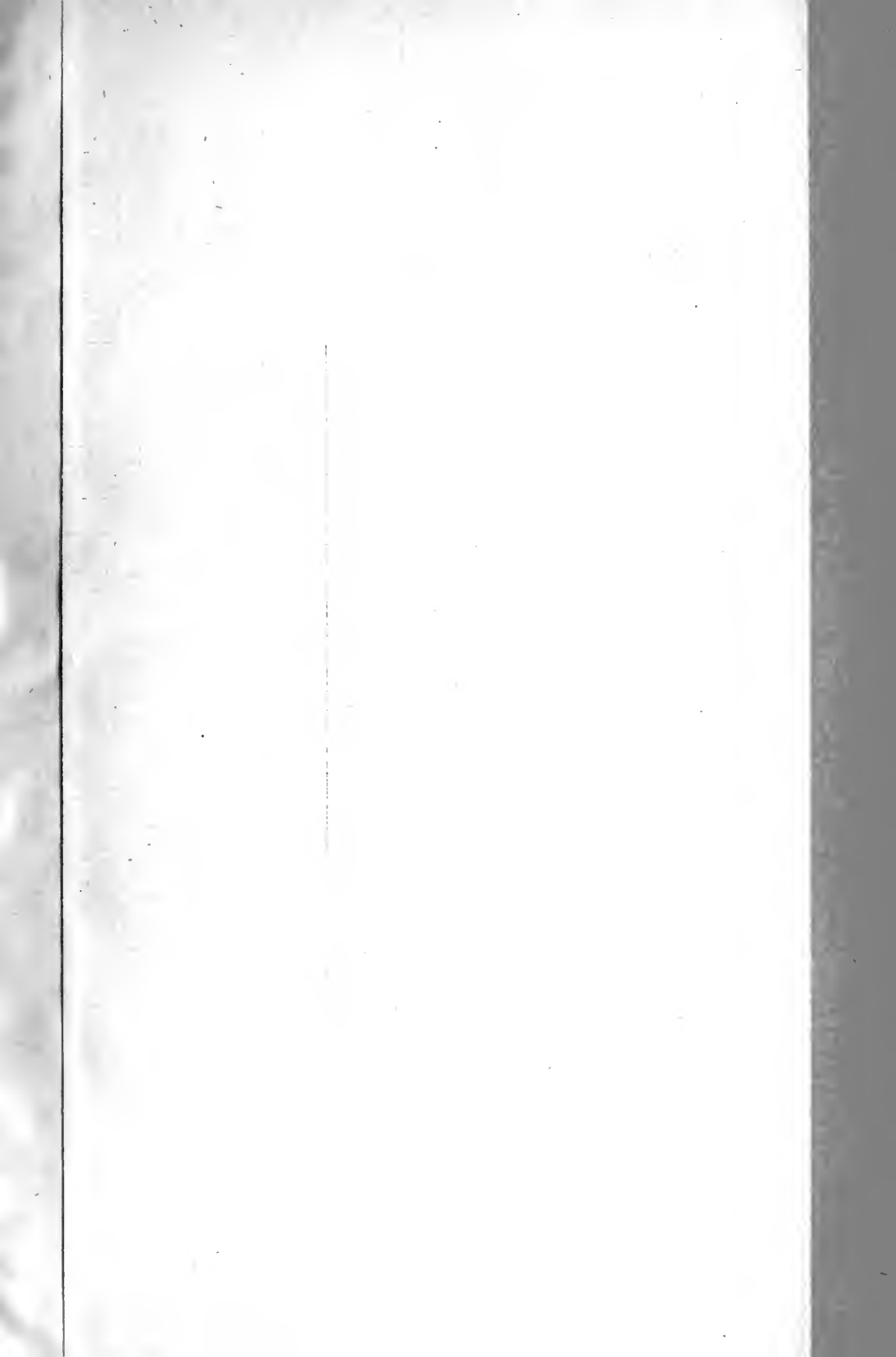


TABLE XI—DAMS AND WATER POWER OF LITTLE MIAMI WATERSHED.

Number.	Stream.	Dam.							Use of dam, if water power, kind of mill.	Water-Power.				
		Approximate Location.	Character.	Height in feet.	Length in feet.	Condition.	Length of backwater in miles.	Approximate pond area in acres.		Average head available.	Kind of Wheels.	Total H. P. claimed.	Approximate time available.	Remarks.
1	Little Miami River.....	Plainville.....	Timber.....	3½	300	Poor.....	4	25	1,665	Flour Mill.....	7	1 Reaction 2 turbines.....	25	10 months..... Little used
2	E. Branch Little Miami.....	Above Batavia.....	Log and stone fill.....	4½	75	Fair.....	½	6	353	Flour and Feed Mill...	8	1 36 in Leffel turbine.....	25	8 months..... Aux. steam.
3	" " ".....	Williamsburg.....	Natural riffle.....						245	Flour Mill.....	20	Overshot 20 ft dia 4 ft breast	25	6 months..... Little used.
4	Little Miami River.....	Symmes.....	" ".....						1,114	" ".....	8	2 48 in and 1 40 in turbine...	40	10 months..... Little used.
5	" " ".....	Loveland.....	Log.....	4	300	Poor.....	1	30	1,106	Not used.....				Mill Burnt.
6	" " ".....	Foster's.....	Timber.....	5	300	Fair.....	1	30	798	Flour Mill.....	8	2 turbine.....	80	10 months.....
											8	1 29 in turbine.....	30	10 months.....
7	" " ".....	King's Mill.....	Timber.....	6	900	Good.....	1	100	792	Powder Mill.....	20	1 50 in and 2 56 in Leffel turbines	700	9 months..... Aux. steam
8	" " ".....	Morrow.....	Brush and stone.....	6	300	Fair.....	½	20	682	Flour Mill.....	9	2 48 in Leffel and 1 44 in Victor turbine	60	9 months.....
9	" " ".....	Hammel.....	" " ".....	4	260	Poor.....	½	10	675	Feed Mill.....	8	1 turbine.....	20	9 months..... Little used.
10	" " ".....	Freeport.....	Timber frame.....	4	310	Good.....	1½	40	658	Flour Mill.....	8	3 36 in Victor turbines.....	100	8 months.....
											8	1 36 in Victor turbine.....	30	8 months.....
11	" " ".....	Above Freeport.....	Brush and stone.....	2	150	Poor.....	½	6	653	Flour Mill.....	7	40-50-60 inch turbines.....	35	Little used.
12	Caesar's Creek.....	Harveysburg.....	Plank and log.....	4	100	Poor.....	½	4	201	Feed Mill.....	8	1 40 in and 1 28 in turbine.....	40	8 months..... Little used.
13	Little Miami River.....	Waynesville.....	Timber and stone.....	3½	150	Fair.....	1	15	410	Flour Mill.....	8	2 turbines.....	75	8 months.....
											8	1 reaction.....	20	8 months.....
14	Gladys Run.....	Spring Valley.....	Timber.....	4	35	Fair.....	½	1	22	Flour Mill.....	24	1 American turbine.....	17	6 months..... Aux. st'm. 140 H. P.
15	Little Miami River.....	Bellbrook.....	Log.....	3	150	Poor.....	1	15	306	Saw Mill.....	7	1 36 in Victor turbine.....	40	8 months..... Little used
											7	1 40 in Victor turbine.....	50	8 months..... Little used.
16	Beaver Creek.....	Alpha.....	Stone fill.....	6	150	Fair.....	½	2	35	Feed Mill.....	8	Overshot 8 ft dia 15 ft breast.	25	6 months..... Little used.
17	Little Miami River.....	Trebeins.....	Timber frame.....	9	230	Fair.....	1	25	246	Flour Mill.....	11	1 48 in American turbine.....	40	8 months..... Aug. gas.
18	" " ".....	Old Town.....	" ".....	6	80	Good.....	½	5	224	" ".....	12	1 30 in Victor turbine.....	65	10 months..... Aux. steam.
19	Massicks Creek.....	Cedarville.....	Cutstone.....	24	30	".....	1	4	62	" ".....	24	2 New American turbines.....	50	9 months..... Aux. steam.
												2 36 in American turbines...		
20	Little Miami River.....	Goe's.....	Timber frame.....	6	90	".....	½	5	120	Powder Mill.....	8½	1 30 in Leffel turbine.....	40	8 months..... Aux. steam.
21	" " ".....	Above Goe's.....	Timber and stone.....	4	75	Fair.....	½	4	113	Flour and Feed Mill...	9		40	9 months..... Little used.
22	" " ".....	S. of Yellow Springs.....	Timber.....	4	80	".....	½	3	109	Feed Mill.....	6	1 48 in Leffel turbine.....	16	9 months.....
23	Branch of Little Miami River..	Yellow Springs.....	Cutstone.....	10	50	".....	½	3	4	Not used.....				
24	Little Miami River.....	Clifton.....	Cutstone.....	15	100	Good.....	½	10	97	Flour Mill.....	26	2 Leffel turbines 26 in & 15 in.	50	9 months..... Little used.
											20	1 Leffel turbine 26 in.....	25	9 months..... Little used.

there were 48 mills using 2,011 horse-power from the canal. If the above figures are correct there was a decline, in twenty years, of 70 percent in the number of separate powers and of 57 percent in the total horse-power in use.

The decline in the use of water-power on the canal is no doubt mainly due to the falling off of navigation, which left many of the mills without sufficient means of obtaining supplies or of disposing of their product. The general tendency to use the more reliable steam power in preference to water-power and the increase of competition, were also factors in the abandonment of the small water powers.

In the water powers supplied from the streams direct the principal and almost only cause in a number of places was the decrease in runoff from the tributary watershed and the increase in the variation of this flow. This is a cause which has been expounded at such length that there is no further need for discussion here. It is altogether too true that the rapid deforesting of the state has seriously affected the regularity of the flow of the streams. Where there was formerly a fairly constant stream of water flowing there is now a variable one, dry in summer and with frequent floods in the spring.

The other factors which enter into the question of the decline in the use of water-power are the filling up of the reservoirs and impounding areas and the natural deterioration of the plants.

The first of the above is one which cannot be avoided and one which requires radical treatment to remedy the evil affects. With the greater variation in the flow of the streams and with a rapidly decreasing storage capacity the water-power available was most seriously affected. Instead of being able to store the night flow for use during the day, it is necessary to depend upon the average daily flow of the stream.

The natural wearing out of the plants from long use, coupled with lack of means for repair and renewal, is causing many of the smaller plants to be abandoned. The old school millers are dying off and the younger men, failing to find the operation of a small isolated mill remunerative enough, abandon it and seek other fields for employment.

It will be noticed from Tables X and XI that the water-power is employed in both these watersheds in a much greater variety of work than in the other watersheds. The isolated powers are still mainly used in flour, feed and saw mills, but the power developed by the hydraulics in Dayton, Middletown, and Hamilton, are used in a number of different industries. The large paper mills of the two last named places derive at least some of their power from this source. In a few cases where the water-power is not sufficient, steam has been substituted and the water of the privilege used for boiler supply, washing purposes, etc.

The Hamilton hydraulic supplies some twelve mills and factories with 434 horse-power. The water is brought from the river by a race five miles long and is distributed to the various powers in such a way

that some have the full head of 26 feet from race direct to the river, a few have a 13 foot head between the race and a tail race, emptying into the old river bed; the remainder having 18 feet head, from a second level to the river. The full head of this last group is not used at present, there being $7\frac{1}{2}$ feet fall between the first and second levels.

The next important power is found at Middletown, where the state dam sends a part of the flow of the river to a hydraulic which now supplies 658 horse-power to six plants, including the city water-works. The fall is obtained between the hydraulic and the river direct and varies from 17 to 18 feet according to the location of the power. This power is good for from ten to twelve months in the year and is one of the best in the district.

At Mianisburg some 330 horse-power is furnished to three mills by a dam in the Great Miami River at West Carrollton. In consideration of supplying a certain amount of water to the canal, this water-way is used as a race for a portion of its length.

At Dayton a hydraulic from Mad River supplies fifteen manufacturing establishments with 384 horse-power, not all of which is in use however. The fall is obtained between different levels of the hydraulic, between these and the canal and between the latter and the river. The water is not sufficient at all times for the power rented and all of the latter is not used.

Above Dayton, at Harshmanville, Mad River furnishes some 300 horse-power to a number of small mills, but at the present time only 40 horse-power is used and this in a shoe factory.

At Piqua a hydraulic supplied principally from the canal, at one time furnished power to a large number of mills. At the present time, however, it only furnishes some 210 horse-power to the city water-works.

In the Little Miami watershed by far the most important power is that developed at King's Mills by the King Powder Company. At first the water was conducted through a long race to a number of isolated mills scattered along the river bank for two miles or more. Now it is conveyed to a central power plant where it is used to generate electricity, which is in turn conveyed to the isolated mills necessary in the manufacture of powder.

AA. STREAM GAGING.

The work in stream gaging has been carried on along the same lines as first laid down with the assistance of Mr. F. H. Newell and Mr. H. A. Pressey, of the United States Geological Survey. To these gentlemen and to Prof. C. N. Brown of the Ohio State University, this Board wishes to express its appreciation for their assistance and coöperation in this work.

During 1900 it was possible to work up the daily discharge of the Sandusky and Maumee rivers for 1899 and 1900 and the results of this work, together with the usual report on the Scioto and Olentangy rivers, is presented in the following tables and plates.

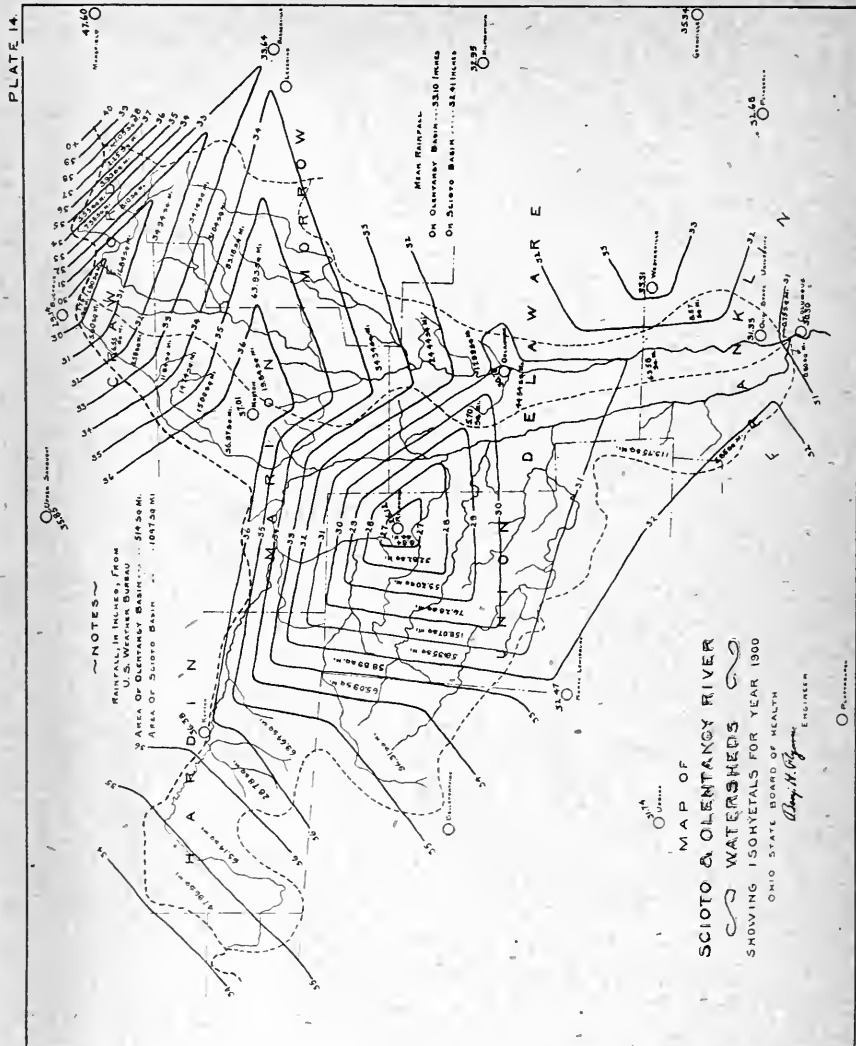
Owing to changes in the stream bed and certain obstructions to the flow it was not possible to work up the discharge of the Sandusky at Fremont for the present report, and the flow of this stream at the Mexico station only is given.

SCIOTO RIVER (ABOVE COLUMBUS) AND OLENTANGY RIVER.

The daily stream heights for these streams were taken by persons in the employ of the Ohio State Board of Health, but, as formerly, the computation of the discharge was made under the direction of Prof. C. N. Brown, of the Department of Civil Engineering of the Ohio State University. The rainfall statistics for the first five months of the year were also worked up under the same direction, but the data for the remainder of the year were compiled by the engineering department of the Board.

As was explained in the last annual report of the Board, the rainfall over these watersheds is secured from the reports of the United States Weather Bureau. The reading of the monthly rainfall for all the stations in the watershed and for those adjacent to the same are taken and the isohyets, or curves of equal rainfall, plotted on the watershed map, then the areas of equal rainfall are measured by a planimeter and the mean rainfall over the entire watershed secured. Except in a few cases of extreme variation in the rainfall, the isohyets for every variation of one-fourth inch in rainfall are put in, so as to make a very close estimate on the mean rainfall of the whole district. It is not possible to put in the twelve maps with the monthly rainfall, but to illustrate the principle the yearly rainfall has been plotted and the isohyets drawn for each inch of variation in the rainfall instead of the one-fourth inch curves as used in the monthly maps.

The mean yearly rainfall as taken from this map was found to be slightly different from that secured by the addition of the figures of mean monthly rainfall. This is probably due to the inaccuracy of the direct yearly estimate due to the absence of complete records from a



number of stations, but which gave data for many of the monthly curves. The discrepancy was not enough to discredit the method in any way, however, but rather to strengthen it.

The following table, XII, shows the rainfall at the stations used and the equivalent rainfall for each watershed as determined by the method outlined above.

TABLE XII — RAINFALL ON SCIOTO AND OLENTANGY WATERSHEDS FOR 1900.

Place.	Jan.	Feb.	March.	April.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Total.
Upper Sandusky.....	2.69	4.14	3.25	2.20	3.05	2.57	4.37	5.06	1.98	2.62	2.57	1.35	35.85
Bucyrus	1.60	2.85	2.00	.....	3.27	4.64	3.40	.....	2.10	.....	.....	.....	47.60
Mansfield	2.89	4.75	4.30	4.85	3.50	4.15	7.88	4.65	2.23	2.15	4.63	1.62	36.38
Kenton	3.11	4.29	2.31	2.30	1.39	5.04	3.67	3.41	1.52	3.67	4.66	1.01	37.01
Marion	3.35	3.86	2.47	3.12	1.33	5.64	3.13	4.52	2.99	1.84	3.45	1.31	33.64
Bangorville	2.53	4.19	2.79	2.16	1.73	2.45	3.84	5.02	2.25	1.74	3.43	1.51	.....
Bellefontaine	1.60	2.55	2.12	2.78	2.61	5.65	3.76	3.43	2.64	2.78	2.75	.....	26.12
Delaware	2.16	3.85	1.32	1.23	1.02	2.49	3.06	3.38	1.08	1.87	3.72	0.94	30.70
Richwood	2.59	3.56	2.44	2.58	1.25	1.99	3.89	5.69	0.62	1.27	3.77	1.05	32.95
Delaware	2.24	2.65	3.17	2.10	1.45	2.45	5.33	4.76	2.43	1.62	3.42	1.33	35.75
Millforttown	2.94	3.56	2.99	1.80	1.90	3.82	2.70	3.98	2.53	5.21	3.08	1.24	31.74
Sidney	3.14	3.25	2.01	2.02	2.36	4.00	2.42	3.33	2.39	1.99	4.45	1.15	31.74
Urbana	2.97	4.00	2.25	2.45	1.90	2.20	3.70	4.20	1.25	1.85	4.06	1.25	33.31
North Lewisburg	2.63	3.01	2.44	2.80	1.86	2.51	3.66	5.20	1.80	2.24	4.45	1.10	35.31
Westerville	2.91	3.65	2.00	1.60	1.48	2.44	5.80	2.65	4.12	2.33	4.88	1.45	30.30
Plattsburg	3.01	3.30	2.59	1.76	1.82	2.45	3.89	3.02	0.97	2.86	3.71	0.92	31.35
Columbus	2.78	3.41	2.56	2.30	1.64	4.10	3.27	3.28	1.57	2.11	3.28	1.05	32.68
Ohio State University	2.92	4.21	3.03	2.41	2.98	1.78	2.77	3.05	1.82	1.98	4.45	1.28	35.34
Pataskala	2.85	3.79	2.89	3.08	1.56	2.42	4.55	3.80	3.12	2.15	3.79	1.34	.....
Granville .....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
Equivalent for Scioto	2.57	3.62	2.04	2.22	1.54	3.77	3.43	3.89	1.62	2.32	3.81	1.13	31.96
Equiv. for Olentangy	2.52	3.52	2.46	2.96	1.76	3.86	3.44	4.81	2.10	1.77	3.66	1.28	34.15

The monthly discharge of the streams is given in Tables XIII and XIV, which were prepared after the usual standard of the U. S. Geological Survey, but with the addition of the ratio of the runoff to the rainfall.

TABLE XIII — MONTHLY DISCHARGE OF OLENTANGY RIVER AT COLUMBUS, 1900.

Drainage area 514 square miles.

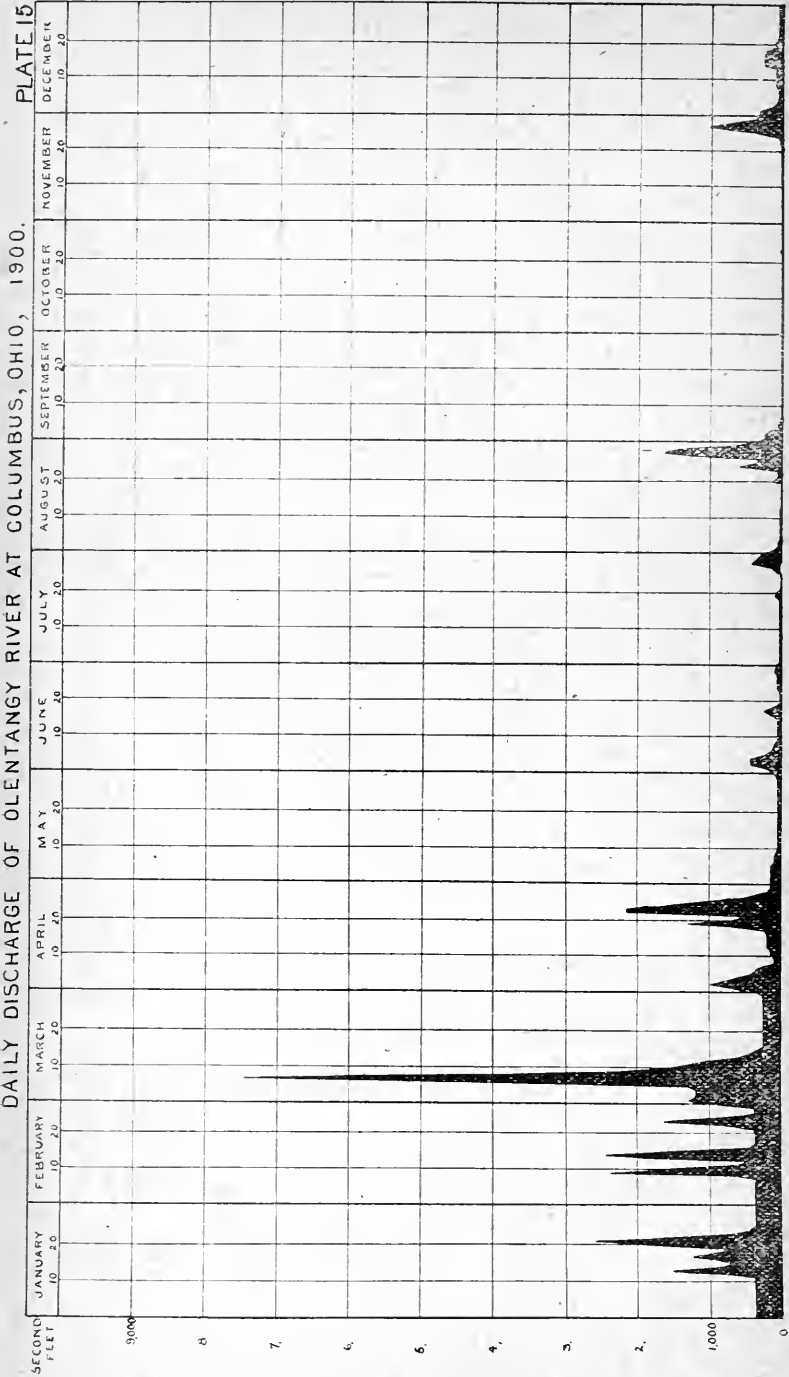
Month.	Discharge in Second-ft ³			Total in acre-feet.	Run-off.			
	Maximum.	Minimum.	Mean.		Sec.-ft. per sq. mile.	Depth in inches.	Rainfall in inches.	Ratio.
1900.								
January	2,580	366	691.0	42,504	1,345	1,551	2.52	.615
February	2,450	305	763.0	42,385	1,485	1,546	3.52	.439
March	7,492	347	1,090.0	67,029	2,121	2,445	2.46	.994
April	2,150	95	560.0	33,310	1,089	1,215	2.96	.410
May	142	55	77.0	4,731	0.150	0.173	1.76	.098
June	427	25	121.0	7,220	0.235	0.263	3.86	.068
July	427	8	74.0	4,546	0.144	0.166	3.44	.048
August	1,630	8	240.0	14,747	0.467	0.538	4.81	.112
September	247	8	34.0	1,997	0.066	0.073	2.10	.035
October	25	8	8.7	536	0.017	0.020	1.77	.011
November	1,030	8	124.0	7,404	0.241	0.270	3.66	.074
December	305	55	111.0	6,428	0.216	0.250	1.28	.195
Year	1,492	8	322.0	232,837	0.627	8,510	34.14	.249

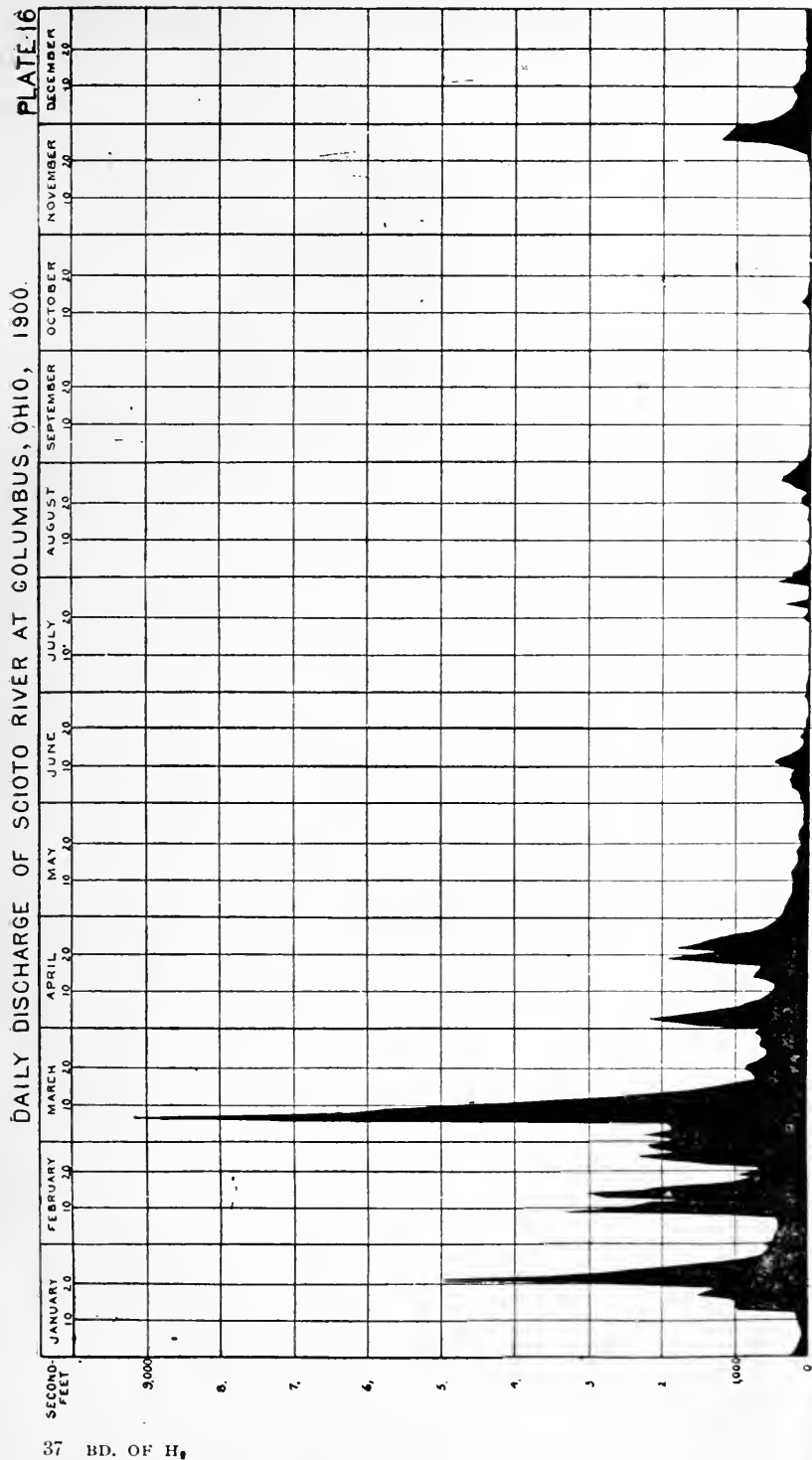
TABLE XIV—MONTHLY DISCHARGE OF SCIOTO RIVER AT COLUMBUS, 1900.

Drainage area 1047 square miles.

Month.	Discharge in Second ft.			Total in acre-feet.	Run off.			
	Maximum.	Minimum.	Mean.		Sec.-ft. per sq mile.	Depth in inches.	Rainfall in inches.	Ratio.
1900.								
January	4,945	75	1,034	63,574	0.990	1.141	2.57	.444
February	3,300	407	1,455	80,799	1.390	1.450	3.62	.399
March	9,165	556	2,131	131,012	2.030	2.351	2.04	1.151
April	2,150	430	1,042	62,011	1.000	1.113	2.22	.501
May	362	92	182	11,173	0.170	2.201	1.54	.130
June	479	11	149	8,842	0.142	0.159	3.77	.042
July	455	11	54	3,342	0.052	0.060	3.43	.017
August	407	5	104	6,401	0.100	0.115	3.89	.030
September	75	1	14	813	0.013	0.015	1.62	.009
October	143	9	25	1,555	0.024	0.028	2.32	.012
November	1,209	11	225	13,374	0.215	2.240	3.81	.063
December	556	35	139	8,527	0.132	0.153	1.13	.135
Year	9,165	1	541	391,423	0.516	7.026	31.96	.220

The daily discharge is shown graphically in the following plates:





SANDUSKY RIVER.

The daily readings of the stream height of the Sandusky River at Mexico date from November, 1898, to November, 1900, when the gage was destroyed and the station abandoned. From time to time meter gagings of this stream have been made, but not until this year were enough data secured to make a discharge curve for it at this point.

Owing to the lack of facilities it was impossible to estimate the rainfall by any means except that of averaging the monthly records of the various stations in and near the watershed. For the watershed above Mexico six stations are used and in the same table there are given two other stations, with a separate average of the eight for use at such time as it is possible to get the discharge at the Fremont station.

The monthly discharge of this stream is shown in Table XVI, and the daily discharge is shown graphically in Plates 17 and 18.

TABLE XVI—MONTHLY DISCHARGE OF SANDUSKY RIVER AT MEXICO, 1898-1900.

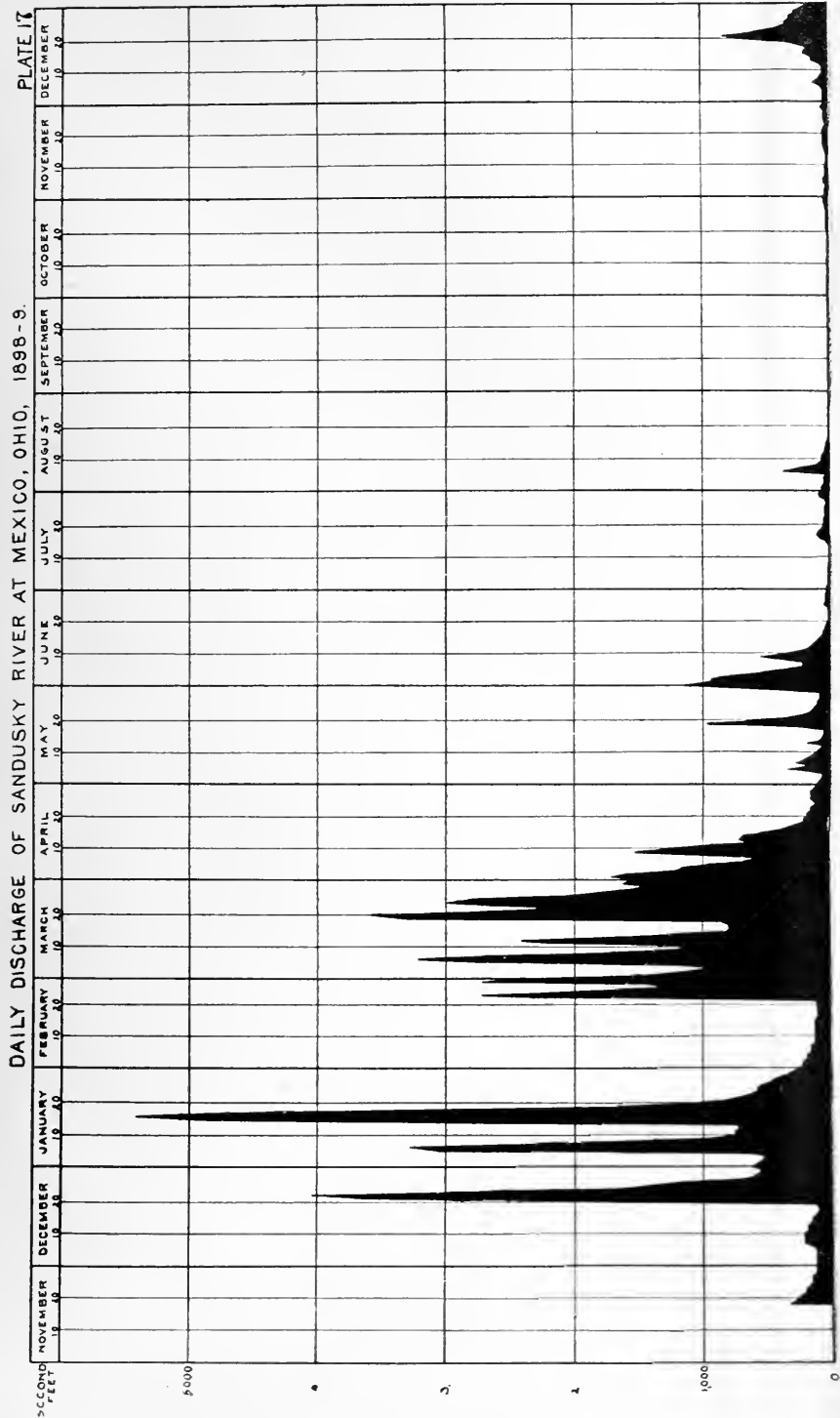
Drainage area 776 square miles.

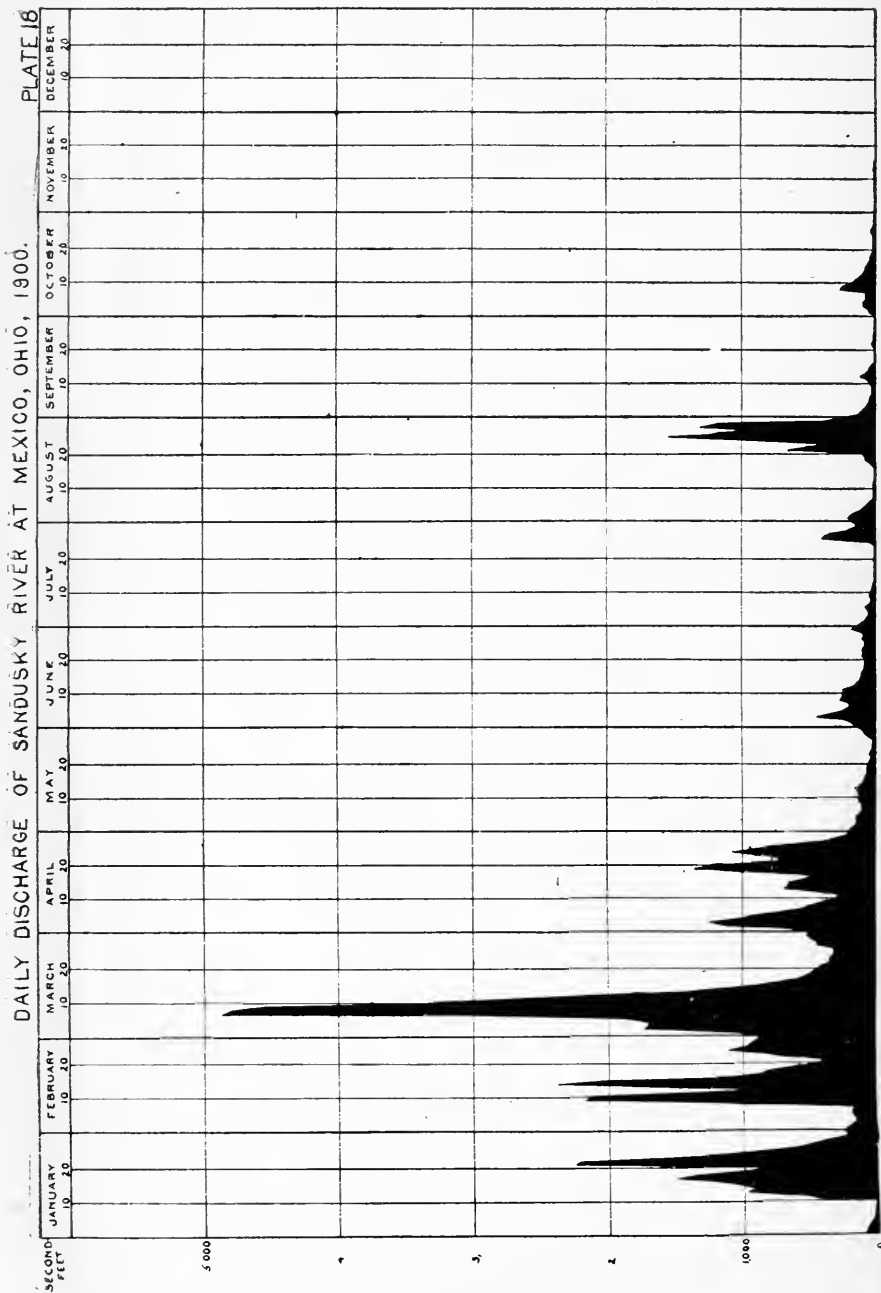
Month.	Discharge in Second-feet			Total in Acre-feet.	Run off.			
	Max.	Min.	Mean.		Sec-ft. per sq. mile.	Depth in inches.	Rain-fall in inches.	Ratio.
1898.								
December ..	4,035	100	727.4	44,726	0.950	1.090	2.65	.411
1899.								
January	5,410	240	1,515.6	93,222	1.953	2.253	3.29	.684
February	2,725	100	636.4	35,344	0.820	0.854	2.21	.386
March	3,580	795	1,871.1	115,049	2.424	3.714	4.84	.767
April	1,730	100	600.2	35,714	0.773	0.856	1.44	.594
May	1,145	45	626.6	13,933	0.292	0.334	4.55	.073
June	935	6	207.5	12,347	0.267	0.297	2.95	.100
July	100	4	31.7	1,949	0.040	0.040	4.82	.008
August	375	3	43.9	2,699	0.056	0.066	1.86	.035
September ..	6	2	2.9	173	0.003	0.003	2.34	.001
October	30	2	8.9	547	0.011	0.011	2.22	.005
November ..	45	12	23.9	1,422	0.030	0.030	2.28	.013
December ...	655	30	170.8	10,502	0.220	0.230	3.20	.072
Year	5,410	2	496.6	322,901	0.640	8.688	36.00	.241
1900.								
January	2,245	8	655.5	40,581	0.844	0.974	2.22	.439
February	2,380	125	888.9	49,367	1.145	1.192	4.18	.285
March	4,870	270	1,407.0	86,513	1.813	2.093	2.64	.793
April	1,355	180	686.2	40,832	0.884	0.984	2.84	.340
May	180	20	88.4	5,436	0.114	0.134	2.57	.521
June	445	80	161.5	9,610	0.208	0.228	3.94	.578
July	410	6	78.7	4,839	0.101	0.121	4.72	.256
August	1,560	4	242.6	14,917	0.312	0.362	4.76	.076
September ...	125	4	38.3	2,279	0.049	0.058	2.04	.028
October	270	8	70.1	4,310	0.090	0.100	2.53	.039



TABLE XV—RAINFALL ON SANDUSKY WATERSHED, 1898-1900.

	1898	1899														1900													
	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Total	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Total		
Bucyrus	1.25	.....	.....	.....	1.33	5.71	2.95	5.01	0.40	3.88	.....	.....	.....	.....	0.60	2.85	2.00	.....	3.27	4.64	3.40	4.63	2.10	1.75	1.03	0.73	.....	
Findlay	2.51	3.19	1.50	4.57	1.77	3.31	2.30	5.08	0.79	1.61	1.91	1.71	3.06	30.80	1.70	5.19	1.52	1.99	2.86	1.60	5.84	6.27	1.50	3.16	3.10	0.08	35.61		
Kenton	3.04	3.46	2.11	4.90	1.21	4.65	1.05	3.28	2.25	1.32	2.05	3.04	2.93	32.25	3.11	4.29	2.31	2.30	1.39	5.04	3.67	3.41	1.52	3.67	4.66	1.01	36.38		
Mansfield	4.30	3.61	2.31	5.55	1.75	4.60	6.42	4.75	1.60	4.55	3.20	2.40	3.39	44.13	2.89	4.75	4.30	4.85	3.50	4.15	7.88	4.65	2.23	2.15	4.63	1.62	47.60		
Marion	1.65	2.97	1.68	4.71	1.45	3.65	2.42	4.73	3.47	1.39	1.79	2.29	3.02	32.97	3.35	3.86	2.74	3.12	1.33	5.64	3.13	4.52	2.99	1.84	3.45	1.31	37.01		
Upper Sandusky	3.14	3.20	2.44	4.48	1.14	5.96	2.55	6.08	2.67	1.30	2.16	1.95	3.60	37.53	2.69	4.14	3.25	2.20	3.65	2.57	4.37	5.06	1.98	2.62	2.57	1.35	35.85		
Mean for Mexico Station ..	2.65	3.29	2.21	4.84	1.44	4.55	2.95	4.82	1.86	2.34	2.22	2.28	3.20	36.00	2.22	4.18	2.64	2.89	2.57	3.94	4.72	4.76	2.04	2.53	3.24	1.15	36.88		
Tiffin.	3.30	3.72	2.20	5.06	2.64	5.42	2.10	4.56	0.90	1.53	2.15	1.84	3.27	35.39	2.19	4.91	2.14	2.55	1.21	3.80	7.55	4.39	0.91	1.91	2.90	0.92	35.38		
Vickery	2.43	3.23	1.49	4.87	0.82	5.27	1.96	3.25	1.38	0.85	1.98	1.71	2.18	28.99	1.74	3.94	1.68	1.72	2.36	3.36	5.89	2.72	1.03	1.46	2.58	0.57	29.05		
Mean for Fremont Station .	2.70	3.34	2.10	4.88	1.51	4.75	2.72	4.59	1.68	2.05	2.18	2.13	3.06	34.99	2.16	4.24	2.46	2.68	2.36	3.85	5.22	4.46	1.77	2.32	3.12	1.05	35.69		





clusky
sts of
: very
r well

n, but
ice on

e, the
e Bay.
work-
gs are

aver-
to the
Scioto-
ailable
nethod
general
ff data
ble.
d from

98 and
arge is-

TABLE XVII—RAINFALL ON MAUMEE WATERSHED, 1898-1900.

	1898				1899												1900												Total
	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Total	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.			
Angola	2.17	3.09	3.17	4.17	0.65	4.43	1.02	4.04	2.77	3.21	3.32	2.37	3.31	35.65	1.37	5.33	2.88	2.21	2.23	4.60	8.02	3.68	1.50	4.35	5.58	0.65	42.48		
Auburn	1.77	2.03	2.91	3.02	0.69	3.62	2.02	4.73	3.73	2.17	3.27	1.89	1.92	31.01	0.76	5.05	1.89	1.98	2.44	5.61	5.29	3.87	1.39	2.44	4.45	0.45	35.62		
Bluffton	2.12	2.60	1.99	4.96	0.97	3.31	2.02	4.61	2.12	1.59	2.60	3.28	2.92	32.47	0.83	3.95	1.92	2.92	3.04	5.01	3.03	4.15	1.87	2.74	3.88	0.93	34.57		
Fort Wayne	2.33	2.34	2.35	5.01	0.70	2.83	2.29	4.28	6.06	3.49	2.30	2.75	3.16	37.56	0.86	5.11	1.87	2.26	3.49	6.05	3.52	.....	1.84	2.83	.....	.....	.....
Adrian	1.85	1.91	2.06	3.87	0.59	5.57	3.35	6.08	2.10	3.24	2.74	1.85	2.39	35.75	0.72	3.26	2.91	1.85	3.83	3.15	7.04	2.50	2.12	2.83	3.90	0.27	33.88		
Hillsdale	1.89	2.44	2.62	4.01	0.87	6.65	3.02	4.81	1.26	3.13	3.24	2.01	2.77	35.23	0.79	4.09	2.55	2.22	2.45	4.49	3.42	1.89	1.55	2.99	4.80	0.43	36.48		
Benton Ridge	3.51	3.70	1.31	5.18	1.48	2.44	1.97	4.21	0.66	0.96	1.74	1.91	3.39	28.95	1.67	5.50	2.81	2.72	2.12	2.54	4.45	4.60	1.66	3.05	3.66	1.18	36.35		
Bowling Green	1.57	2.17	2.39	4.59	1.21	3.24	2.33	4.33	0.75	2.01	2.47	1.84	2.70	30.63	0.97	3.36	1.33	2.45	2.95	3.80	3.76	4.24	0.85	2.95	3.32	1.00	30.98		
Celina	1.85	2.76	1.88	3.67	0.70	2.92	1.67	4.06	.....	.....	2.01	2.03	4.01	.....	1.58	4.99	2.21	2.05	2.17	4.07	2.33	4.18	1.51	1.87	2.43	1.33	30.72
Defiance	2.40	2.08	2.21	3.99	2.49	3.05	1.64	4.22	1.77	3.71	2.63	2.06	3.50	33.35	1.20	4.41	1.81	3.17	3.21	5.36	6.03	2.58	1.07	3.07	3.76	0.50	36.26		
Findlay	2.51	3.19	1.50	4.57	1.77	3.31	2.39	5.08	0.79	1.61	1.91	1.71	3.06	30.89	1.70	5.19	1.52	1.99	2.06	1.60	5.84	6.27	1.50	3.16	2.10	0.88	35.61		
Hedges	2.50	2.88	1.54	.....	.....	2.37	.....	.....	.....	.....	.....	.....	.....	36.26	.....	3.11	1.14	2.35	2.89	4.22	4.75	2.85	0.92	2.78	4.10	0.72	.....	
Kenton	3.04	3.46	2.11	4.90	1.21	4.65	1.65	3.28	2.25	1.32	2.05	3.04	2.93	32.25	3.11	4.29	2.31	2.30	1.39	5.04	3.67	3.41	1.52	3.67	4.66	1.01	36.38		
Leipsic	2.58	2.57	1.82	4.62	0.56	.....	1.00	.....	2.50	1.50	2.80	1.63	.....	.....	.....	.....	.....	.....	.....	.....	4.80	2.45	0.70	1.55	.....	0.75	.....	
Montpelier	2.55	2.09	2.01	3.41	1.92	3.65	2.05	.....	.....	.....	.....	.....	.....	.....	0.96	4.44	2.39	2.23	2.60	6.61	6.35	2.16	1.63	3.62	3.92	0.57	36.97
Napoleon	3.00	1.25	2.32	4.39	1.56	2.68	1.51	5.19	0.85	3.60	2.24	1.63	3.48	30.90	0.65	4.33	2.79	2.50	2.30	5.47	3.48	2.80	1.94	2.62	3.61	0.95	32.84		
New Bremen .....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	1.12	.....	.....	1.74	2.28	3.91	2.37	4.09	1.84	2.19	4.22	1.09	.....	
Ottawa	2.48	2.84	1.58	4.52	1.45	2.94	1.65	3.25	2.85	1.86	2.36	1.88	3.26	30.44	1.42	4.55	1.67	2.21	2.00	2.89	3.88	3.10	1.11	2.03	3.37	1.05	29.34		
Swanton .....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	3.32	1.03	.....	.....
Van Wert	2.25	2.25	1.70	4.76	0.44	.....	1.80	6.00	.....	2.35	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	5.74	1.55	2.12	3.27	.....	.....	.....
Wauseon	3.28	3.00	4.52	5.47	1.19	4.53	1.11	4.52	0.84	2.70	2.50	2.17	3.36	36.81	1.50	5.57	2.17	4.04	4.12	3.91	5.71	2.97	1.61	3.09	4.48	0.93	39.38		
TOTAL	45.71	49.46	40.69	79.11	19.95	62.21	33.86	71.09	31.30	38.45	40.19	33.86	46.16	.....	21.21	76.43	36.17	43.19	47.77	77.43	92.74	67.71	29.08	55.95	73.93	15.81	.....	
MEAN	2.41	2.60	2.14	4.39	1.11	3.66	1.88	4.36	2.09	2.40	2.51	2.12	3.08	32.34	1.25	4.50	2.13	2.40	2.65	4.30	4.89	3.56	1.45	2.80	3.89	0.83	34.65		

At Mexico, where the above gaging station is located, the Sandusky River has a watershed of 776 square miles. This district consists of rolling farm land in a rather high state of cultivation. There are very few tracts of timber, of any size, left and the fields are fairly well drained by ditches and tiling.

There are six small dams in the river above the gaging station, but they store very little water and seem to have no perceptible influence on the flow at Mexico.

MAUMEE RIVER.

The gaging station on this stream was placed at Waterville, the first available place above the influence of back-water from Maumee Bay. This station was also established in November, 1898, by the Board, working in connection with the U. S. Geological Survey and the readings are still being taken.

The mean monthly rainfall on this watershed was secured by averaging the depth reported from 21 stations within or neighboring to the drainage basin. It is recognized that the method used on the Scioto and Olentangy is much more accurate, but the time and facilities available would not allow its use on these districts. On the other hand this method of simply averaging the data from scattered stations is the one in general practice and it can be safely asserted that there are but few runoff data extant where as many stations in proportion to the area are available.

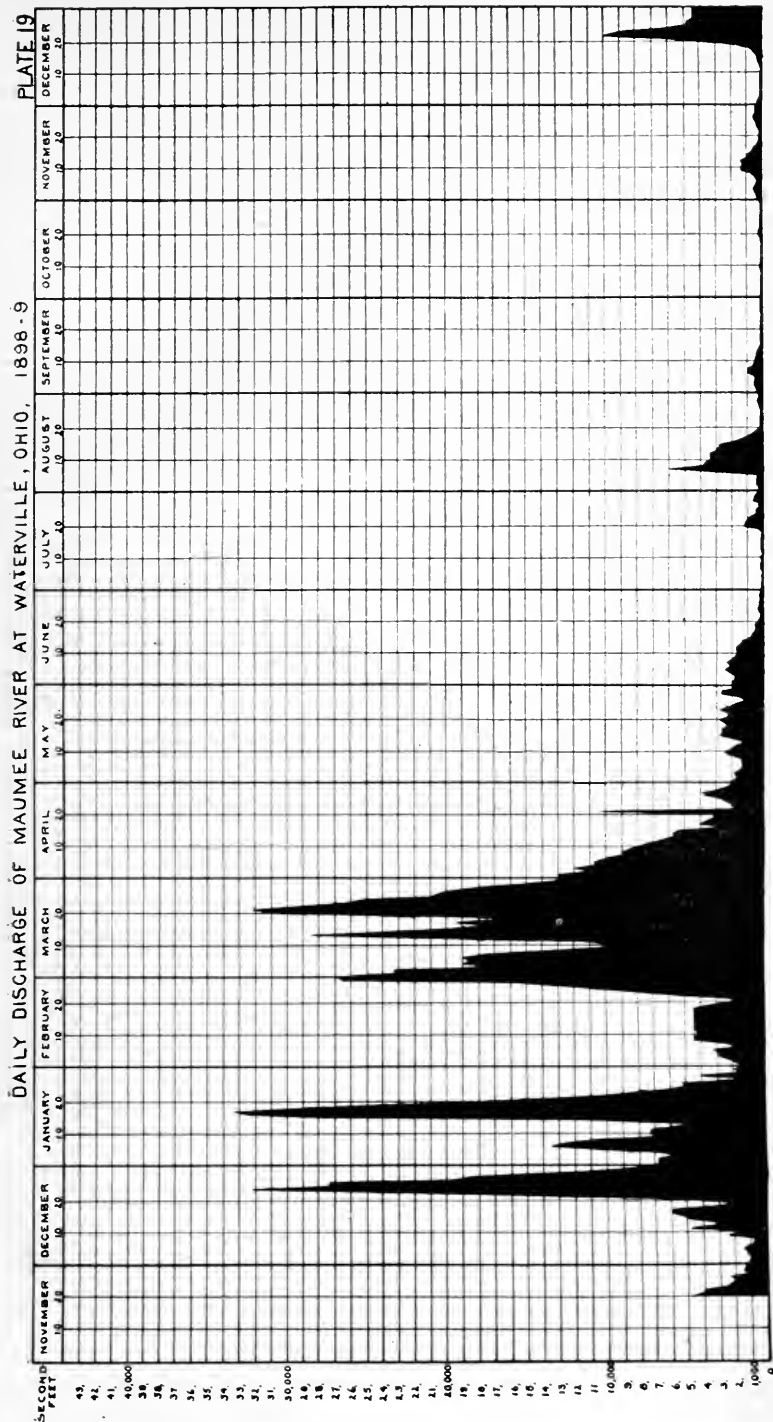
Table XVII gives the rainfall stations used and the mean found from these.

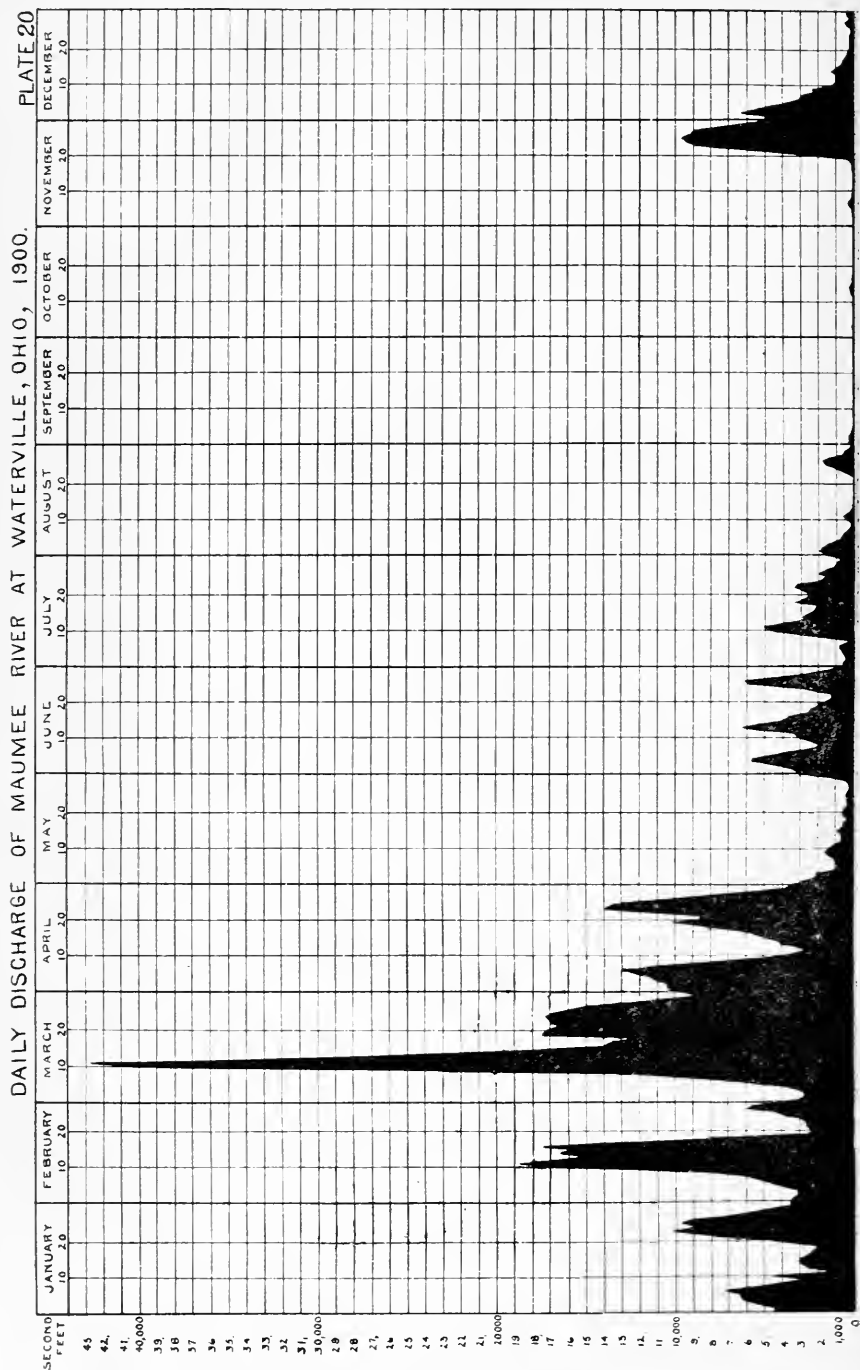
The monthly discharge of this stream for the portion of 1898 and for 1899 and 1900 is given in Table XVIII, and the daily discharge is shown by Plates 19 and 20.

TABLE XVIII—MONTHLY DISCHARGE OF MAUMEE RIVER AT
WATERVILLE, 1898-1900.

Drainage area 611 square miles.

Month.	Discharge in Second-feet.			Total in Acre-Feet	Run off.			Ratio.
	Max.	Min.	Mean.		Sec-ft. per sq. miles.	Depth in inches.	Rain- fall in inches.	
1898.								
December .	32,120	680	8,203.4	504,407	1.325	1.525	2.41	.632
1899.								
January ..	33,250	780	10,979.0	675,072	1.796	2.070	2.60	.796
February .	26,765	1,310	6,301.2	349,950	1.080	1.070	2.14	.500
March ...	32,100	8,700	19,431.4	1,194,790	3.180	3.660	4.39	.833
April	12,960	1,800	6,027.5	358,661	.986	1.095	1.11	.986
May	2,750	1,200	1,990.0	352,360	.325	.375	3.66	.102
June	2,450	150	1,057.3	62,814	.173	.203	1.88	.108
July	1,200	3	285.3	17,536	.046	.046	4.36	.011
August ...	4,940	70	1,362.2	43,758	.223	.253	2.09	.121
September	990	20	259.0	15,411	.042	.042	2.40	.018
October ..	150	5	48.1	2,955	.007	.007	2.51	.003
November	1,310	40	521.0	31,001	.085	.085	2.12	.040
December .	9,950	10	2,323.2	142,847	.380	.450	3.08	.146
Year	33,250	3	5,211.7	3,017,155	.689	9.356	32.34	.227
1900.								
January ...	10,200	1,200	5,053.9	310,752	.827	.947	1.25	.757
February .	18,985	2,450	7,943.9	441,180	1.300	1.342	4.50	.298
March	42,750	2,600	15,609.7	959,803	2.554	2.942	2.13	1.381
April	13,965	2,600	8,149.1	484,904	1.330	1.480	2.40	.617
May	3,050	200	937.7	57,657	1.530	1.760	2.65	.664
June	6,320	680	3,443.6	204,907	.563	.623	4.30	.145
July	5,120	300	2,093.5	128,724	.342	.392	4.89	.080
August ...	1,930	5	562.7	34,598	.092	.104	3.56	.029
September	250	5	26.8	1,596	.004	.004	1.45	.003
October ..	250	5	40.6	2,499	.006	.006	2.80	.002
November	9,700	10	2,619.0	155,840	.428	.478	3.89	.123
December	6,320	70	1,508.7	92,766	.246	.286	.83	.344
Year	42,750	5	4,665.7	2,275,226	7.635	10.364	34.65	.299





This watershed has an area of 6,111 square miles, portions of which are in both Indiana and Michigan. The central and southern parts of the district are quite level, while the northern is more rolling. In portions of the watershed, notably the central part, there are still extensive areas of scrub-timber land, but by far the largest part is under cultivation or cleared for grazing.

The Miami and Erie canal goes through this watershed and appropriates for its use at St. Mary's, Grand Rapids, and Defiance, a portion of the flow of the stream. This water is in part returned at the numerous waste ways, but much of it is returned to the river below the gaging station.

It is impossible to estimate the amount of water diverted and the influence it would have on the low flows. This factor destroys some of the value of the figures on the percentage of runoff, but in general they can be taken as correct.

INDEX.

	PAGE
Abstract of the reports of deaths and their causes.....	325
Summary of	375
Albuminoid ammonia (see nitrogen as albuminoid ammonia).	
Alexanderville	507
Alkalinity —	
Discussion	473, 478, 482, 487
Plates	443, 454, 465
Analysis of miscellaneous waters.....	214
Annual report —	
Printing of	43
Of local boards of health.....	233
Of township boards of health.....	322
Area of Great Miami watershed.....	493
Little Miami watershed.....	493
Watersheds, table of.....	494
Ashville, report of a nuisance at.....	164
Bacteria —	
Discussion	474, 478, 482, 488
Plates	447, 458, 469
Bacteriological examinations (see examinations).	
Batavia	519
Analysis of water supply of.....	194
Discussion	471-476
Map of	394
Report on water supply of.....	57
Results of examination.....	422
Samples from	400-410
Sampling stations	398
Sewerage of	525
Water supply	26, 28, 547
Barberton —	
Sewerage for Columbia Chemical Co. at.....	44, 113
Beach City —	
Smallpox at	35
Bear Creek	506
Beaver Creek	516, 523
Bellefontaine —	
Report on	57
Sanitary condition of.....	165
Sewerage	525
Water supply	549
Bellevue —	
Analysis of water supply of.....	195
Smallpox at	35
Water supply for.....	29, 44, 59

	PAGE
Blanchester	521
Water supply	549
Report on a nuisance at.....	168
Bloom township, Fairfield county —	
Smallpox in	35
Boards of health.....	14
List of	219
Annual reports of.....	233
Bowling Green —	
Sewerage for	39, 40, 115
Brookville	508
Buck Creek	509, 510
(For chemical examination see Mad River.)	
Buckinjahalis Creek	516
Bucyrus —	
Water supply for.....	26, 28, 60
Butler County Infirmary.....	503
Caesar's Creek	522
Caldwell —	
Sewerage for	17
Cambridge—	
Water supply for.....	17, 41
Canal Dover —	
Sewerage for	27, 118
Canton —	
Analysis of water supply of.....	195
Smallpox at	33
Water supply for.....	29
Carlisle	506
Cedarville	524
Champaign County Children's Home.....	511
Champaign County Infirmary.....	511
Chapman Creek	511
Chemical examinations (see examinations).	
Chillicothe —	
Sewerage of	37, 42
Chlorine —	
Discussion	472, 477, 481, 487
Plates	442, 453, 464
Circleville —	
Sewerage of	37
Clarke County Infirmary.....	510
Classification of public water supplies of Great and Little Miami watersheds...	544
Clear Creek	506
Clermont County Infirmary.....	519
Cleveland —	
Smallpox at	33
Sewerage for Gordon Park.....	120
Cleves —	
Results of examination.....	434
Samples from	400-410
Sampling stations	400
Clifton	525

	PAGE
Clinton County Children's Home.....	522
Clinton County Infirmary.....	522
Color (see physical properties.)	
Columbia Chemical Co., Barberton, sewerage for.....	113
Columbus —	
Analysis of water supply of.....	196
Sewage purification for.....	39, 42
Conneaut —	
Sewerage for	26, 30, 120
Smallpox at	32
Water supply for.....	19, 64
Continental, smallpox at.....	35
Corwin	523
County Children's Homes —	
Sewerage and water supply of.....	533
County Infirmaries —	
Sewerage and water supply of.....	533
Covington	512
Cridersville, smallpox at.....	34
Cuyahoga Falls —	
Water supply for.....	45, 65
Dairy farms	519
Dams and water power.....	568
Darke County Children's Home.....	513
Darke County Infirmary.....	513
Dayton	507
Analysis of water supply of.....	208
Map of	388
Results of examination.....	424, 428, 432
Samples from	400-410
Sampling stations	398, 399
Sewerage of	525
Water supply of.....	27, 67, 550
Dayton State Hospital.....	507
Sewerage and water supply of.....	531
Dead bodies, shipment of.....	18
Deaths —	
Abstract of reports of.....	325
Summary of	375
DeGraff	516
Delaware —	
Sewerage for	44, 121
Smallpox at	21
Dennison —	
Smallpox at	35
Test of filters at.....	68
Dick's Creek	504
Diphtheria —	
Examination of specimens for.....	191
Discussion of analytical results —	
Great Miami River.....	484
Little Miami River.....	471
Mad River	479

	PAGE
Stillwater River	476
Discharge —	
Daily of Maumee River at Waterville for 1898-99 — Plate 19.....	583
Daily of Maumee River at Waterville for 1900 — Plate 20.....	584
Daily of Olentangy River at Columbus — Plate 15.....	576
Daily of Sandusky River at Mexico for 1898-99 — Plate 17.....	579
Daily of Sandusky River at Mexico for 1900 — Plate 18.....	580
Daily of Scioto River at Columbus — Plate 16.....	577
Monthly of Maumee River at Waterville — Table 18.....	582
Monthly of Olentangy River at Columbus — Table 13.....	574
Monthly of Sandusky River at Mexico — Table 16.....	578
Monthly of Scioto River at Columbus — Table 14.....	575
Donnells Creek	509
Drainage of Great and Little Miami watersheds.....	496
Dry Run	509
Duck Creek	518
Dugan Creek	511
East Branch Little Miami River.....	579
(For chemical examination see Little Miami River.)	
Eaton	504
Water supply	551
Elk Creek	504
Elyria, smallpox at.....	34
Euon	509
Evanston	519
Sewerage for	37, 45, 123, 526
Examinations —	
Methods of	397
Results of	419
Fairfield	509
Fever, report on an outbreak of, at Lake Erie College.....	49
Filters, test of, at Dennison.....	68
Findlay —	
Report on examination of high school building at.....	170
Smallpox at	31
Fort Ancient	522
Fort Recovery, water supply for.....	44, 75
Fostoria, report of a nuisance caused by sewage of.....	172
Four Mile Creek.....	503
Franklin	506
Sewerage	526
Water supply	551
Fredericksburg, smallpox at.....	35
Free ammonia (see nitrogen as free ammonia.)	
Freeport	522
Galion —	
Smallpox at	22
Sewerage of	22
Water supply of.....	22, 78
Garbage disposal —	
For Mansfield	138
For Marion	149
General description of Great and Little Miami watersheds.....	493

	PAGE
General topography of Great and Little Miami watershed.....	495
Geneva, water supply for.....	39, 40
Geology of Great and Little Miami watersheds.....	496
Germantown	505
Glouster, water supply for.....	83
Goes Station	524
Gordon Park, Cleveland, sewerage for.....	29
Gradient, approximate, of principal streams of Great and Little Miami watersheds	497
Great Miami River.....	505, 506, 514, 515, 516, 517
Location and amount of pollution of this stream.....	502
Discussion of examinations of.....	484
Plates	459-469
Rainfall	414
Report on examinations of.....	396
Samples from	400
Sampling stations	398
Summary	489
Table of results of examinations.....	428
Great Miami watershed —	
Map of	380
Geology	496
Drainage	496
Population	499
Pollution of	501
Sources of pollution.....	501
Amount of pollution.....	502
Report of sanitary survey of.....	491
Introduction to report of sanitary survey of.....	492
General description of	493
Area of	493
General topography	495
Ice supplies	540
Public water supplies.....	543
Detailed description of plants	547
Dams and water power.....	568
Greene County Children's Home.....	524
Greene County Court House, report on sanitary condition of.....	181
Greene County Infirmary.....	524
Gregory Creek	504
Greenville Creek	512
(For chemical examinations of, see Stillwater River.)	
Greenville	512
Discussion	476-479
Samples from	400-410
Sampling stations	398
Results of examinations.....	424
Map of	387
Sewerage of	526
Sewerage for	16, 17, 45, 123
Water supply of.....	552
Water supply for.....	19

	PAGE
Hamilton	503
Issue of bonds.....	16, 17, 18
Map of	390
Results of examinations.....	434
Samples from	400-410
Sampling stations	400
Sewerage	526
Water supply	552
Harshmanville	508
Health officers, list of.....	219
Hodge Creek	517
Holgate, smallpox at.....	34
Honey Creek	514
Hyde Park	518
Sewerage	527
Ice, bill regulating cutting and sale of.....	20, 29
Ice supplies of Great and Little Miami watersheds.....	540
Incrusting constituents —	
Discussion	473, 478, 482, 487
Plates	444, 455, 466
Indian Creek	503
International Congress of Hygiene, delegate to.....	17
Introduction to examinations of Little and Great Miami rivers and their tributaries	397
Introduction to sanitary surveys of the Great and Little Miami watersheds....	492
Isohyetals of Scioto and Olentangy watersheds.....	572
Isolated public institutions —	
Sewerage of	530
Notes on water supplies of.....	530
Kennedy Heights	518
Kenton, sewage purification for.....	44, 125
Knights of Pythias Home.....	510
Sewerage and water supply of.....	532
Laboratory	14, 25
Examination of specimens for dipttheria.....	191
Expenses of	190
Miscellaneous examinations	193
Water analyses	193
Work done in	189
Lake Erie College, report on an outbreak of fever at.....	49
Lakewood, sewerage and sewage disposal for.....	28, 38, 128
Lebanon —	
Chickenpox at	34
Sewerage	527
Water supply	553
Leetonia, water supply for.....	87
Legislation	30
Leipsic, water supply for.....	45, 89
Letter of transmittal.....	3
Lewisburg	506
Lima, sewerage for.....	26, 28, 137

	PAGE
Linwood —	
Discussion	471-476
Results of examinations	422
Samples from	400-410
Sampling station	398
Little Miami River.....	518, 519, 520, 521, 522, 523, 524
Discussion of examinations of.....	471
Plates	437-447
Rainfall	411
Report of examinations of.....	396
Samples from	400
Sampling stations	398
Summary of	475
Table of results of examinations.....	420
Little Miami watershed —	
Area of	493
Amount of pollution.....	502
Dams and water power.....	568
Drainage	496
General description of.....	493
General topography	495
Geology	496
Ice supplies	540
Introduction to report on sanitary survey of.....	492
Map of	380
Pollution of	501
Population	499
Public water supplies.....	543, 547
Report on sanitary survey of.....	491
Sources of pollution.....	501
Lodi, smallpox at.....	34
Logan County Children's Home.....	516
Logan County Infirmary.....	517
Loganville	517
Lorain —	
Smallpox at	31, 34
Water supply of.....	41
Loramie Creek	515
Lost Creek	514
Loveland	520
Discussion	471-476
Samples from	400-410
Sampling station	398
Results of examinations.....	420
Ludlow Creek	512
Lynchburg	520
Water supply for.....	41, 91, 553
McConnelsville, water supply for.....	19, 93
McGuffey, smallpox at.....	34
Madeira	518
Madisonville	518
Sewerage	527
Water supply	554

	PAGE
Mad River	508, 509, 511
Discussion of examination of.....	479
Plates	448-458
Rainfall	414
Samples from	400
Sampling stations	398
Summary	483
Table of results of examinations.....	426
Mansfield, sewage and garbage disposal for.....	16, 17, 20, 26, 27, 138
Map of —	
Batavia	394
Dayton	388
Great and Little Miami watersheds.....	380
Greenville	387
Hamilton	390
Middletown	389
Piqua	385
Showing principal sources of sewage pollution of Miami watersheds.....	537
Sidney	384
Springfield	392
Troy	386
Urbana	391
Xenia	393
Marion, sewage and garbage disposal for.....	17, 19, 149
Masonic Home	509
Sewerage and water supply of.....	532
Massicks Creek	524
Maumee River, gagings of.....	581
Medical inspectors, appointment of.....	23
Medway	509
Methods of examination.....	397
Miami County Children's Home.....	514
Miami County Infirmary.....	515
Miami rivers, examination of.....	38
Miamitown	502
Miami University, sewerage and water supply of.....	531
Miami watersheds, diagram of.....	470
Middletown	505
Analysis of water supply of.....	209
Map of	389
Results of examinations.....	432
Samples from	400-410
Sampling stations	399
Sewerage	527
Water supply	555
Mineral Point, smallpox at.....	35
Mingo Junction —	
Analysis of water supply of.....	210
Investigation at	29, 47
Water supply of.....	44
Minster	515
Minutes of board meetings.....	16

	PAGE
Montgomery County Infirmary.....	507
Sewage disposal at.....	533
Morrow	521
Mortality reports--	
Abstract of	325
Summary of	375
Mosquito Creek	516
Mt. Holly	523
Mt. Washington	518
Napoleon, sewerage of.....	37
National Soldiers' Home.....	507
Sewerage and water supply of.....	530
Nettle Creek	511
Newark, smallpox at.....	35
New Baltimore	502
New Bavaria, smallpox at.....	35
New Berlin, smallpox at.....	35
New Vienna	520
Niles, smallpox at.....	23
Nitrogen as albuminoid ammonia —	
Discussion	471, 477, 480, 485
Plates	438, 449, 460
Nitrogen as free ammonia —	
Discussion	472, 477, 481, 486
Plates	439, 450, 461
Nitrogen as nitrates —	
Discussion	472, 477, 481
Plates	441, 452, 463
Nitrogen as nitrites —	
Discussion	472, 477, 480
Plates	440, 451, 462
Noblesville	509
Norwood	518
Sewerage	527
Water supply	556
Nuisance —	
Investigation of, at Ashville.....	164
Investigation of, at Blanchester.....	168
Investigation of, caused by sewage of Fostoria.....	172
Investigation of, at Perrysburg.....	21
Investigation of, at Sabina.....	174
Investigation of, at Sidney.....	177
Investigation of, at Wapakoneta.....	179
Investigation of, at Xenia Township, Greene County.....	18, 28, 182
Report of, at Bellefontaine.....	165
Obanon Creek	521
Odd Fellows Home.....	510
Sewerage and water supply of.....	532
Odor (see physical properties).	
Ohio Funeral Directors' Association, legislation for.....	17
Ohio Hospital for Epileptics, water supply for.....	27, 85
Ohio Soldiers' and Sailors' Orphans' Home.....	524
Nuisance caused by sewage of.....	18, 28, 182
Sewerage and water supply of	532

	PAGE
Olentangy River, gagings of.....	571
Osborn	509
Water supply of.....	556
Oxford	503
Analysis of water supply of.....	210
Water supply of.....	557
Oxford College, sewerage and water supply of.....	532
Oxford Retreat, sewerage and water supply of.....	532
Oxygen, dissolved —	
Discussion	474, 478, 487
Plates	446, 457, 468
Oxygen required —	
Discussion	471, 477, 480, 485
Plates	437, 448, 459
Painter Creek	512
Painesville, water supply for.....	45, 94
Passenger cars, unsanitary condition of.....	29
Pemberton	516
Perrinville	519
Perrysburg —	
Proposed sewerage for.....	20
Nuisance at	21
Perry Township, Wood County, report of nuisance in.....	72
Physical properties, discussion.....	471, 475, 476, 480, 484
Piqua	515
Map of	385
Results of examination.....	430
Samples from	400-410
Sampling stations	399
Sewerage	527
Water supply	16, 17, 20, 95, 557
Plain City —	
Smallpox at	22
Sewerage for	27, 41
Plates —	
Alkalinity	443, 454, 465
Ammonia, albuminoid	438, 449, 460
Ammonia, free,	439, 450, 461
Bacteria	447, 458, 469
Chlorine	442, 453, 464
Discussion of	471
Incrusting constituents	444, 455, 466
List of	436
Nitrates	441, 452, 463
Nitrites	440, 451, 462
Oxygen, dissolved	446, 457, 468
Oxygen required	437, 448, 459
Solids, total	445, 456, 467
Map showing principal sources of sewage pollution of Miami watersheds....	537
Isohyetals of Scioto and Olentangy watersheds.....	572
Daily discharge of Olentangy River at Columbus.....	576
Daily discharge of Scioto River at Columbus.....	577
Daily discharge of Sandusky River at Mexico, 1898-9.....	579

Plates — Concluded.	PAGE
Daily discharge of Sandusky River at Mexico, 1900.....	580
Daily discharge of Maumee River at Waterville, 1898-9.....	583
Daily discharge of Maumee River at Waterville, 1900.....	584
Pleasant Hill	512
Pleasant Ridge	518
Plumb Creek	516
Pollution of Great and Little Miami watersheds.....	501
Sources of	501
Amount of	502
Summary of	535
Population of Great and Little Miami watersheds.....	499
Table of on Great and Little Miami watersheds.....	500
Port Jefferson	516
Preble County Children's Home.....	504
Preble County Infirmary.....	504
Public water supplies of Great and Little Miami watersheds.....	543
Classification of	544
Detailed description of plants.....	547
Quincy	516
Rainfall —	
Discussion of	415
Table of	411
On Maumee watershed.....	581
On Sandusky watershed.....	578
On Scioto and Olentangy watersheds.....	573
Report of the examination of the Great and Little Miami rivers and their tribu- taries	396
Report upon a sanitary survey of the watersheds of the Great and Little Miami rivers	491
Result of examination of Miami rivers.....	419
Ross	502
Sabina, report of a nuisance at.....	174
St. Paris	511
Salem —	
Use of sewer pipe for water conduit at.....	28, 175
Sewerage of	37
Samples —	
List of	400-410
Weather history of.....	416
Sampling stations, description of.....	398
Sandusky River, gagings of.....	578
School building, report of an investigation of at Findlay.....	170
Scioto River, gagings of.....	571
Sebring, water supply for.....	20, 99
Sediment (see physical properties).	
Seven Mile Creek.....	503, 504
Sewage disposal —	
For Columbus	39, 42
Kenton	44, 125
Lakewood	27, 128
Mansfield	16, 17, 20, 26, 27, 138
Marion	17, 19, 149
Montgomery County Infirmary.....	533
Xenia	26, 28, 42, 163

	PAGE
Sewerage and water supply of—	
County infirmaries	533
County children's homes.....	533
Ohio Soldiers' and Sailors' Orphans' Home.....	532
Wilberforce College	532
Odd Fellows' Home.....	532
Knights of Pythias Home.....	532
Masonic Home	532
Oxford Retreat	532
The Western	532
Oxford College	532
Miami University	531
Dayton State Hospital.....	531
National Soldiers' Home.....	530
Sewerage	11
For Bowling Green.....	39, 40, 115
Caldwell	17
Canal Dover	27, 118
Chillicothe	37, 42
Cleveland, Gordon Park.....	29, 120
Columbia Chemical Company, Barberton.....	44, 113
Conneaut	26, 30, 120
Delaware	44, 121
Evanston	37, 45, 123
Greenville	16, 17, 123
Lakewood	27, 128
Lima	26, 28, 137
Perrysburg	20
Plain City	27, 41
Sidney	18, 37
South Brooklyn	27, 42, 158
Toledo	16, 17, 20, 26, 40, 160
Zanesville	18, 19
Of Bellefontaine	165
Circleville	37
Cities and villages of Miami watershed having public water supplies.....	525
Galion	22
Isolated public institutions.....	530
Napoleon	37
Salem	37
Warren	37, 161
Sewer pipe, use of as a water conduit.....	175
Shawnee Run	523
Shelby County Children's Home.....	516
Shelby County Infirmary.....	515
Shreve, analysis of water supply of.....	211
Sidney	515
Investigation of alleged nuisance at.....	177
Map of	384
Results of examination.....	428
Samples from	400-410
Sampling stations	399
Sewerage of	18, 37, 527
Water supply	558

	PAGE
Silverton	518
Smallpox	5
At Beach City.....	35
Bellevue	35
Bloom Township, Fairfield County.....	35
Canton	33
Cleveland	33
Conneaut	31
Continental	35
Cridersville	34
Delaware	21
Dennison	35
Elyria	34
Findlay	31
Fredericksburg	35
Galion	22
Holgate	34
Lodi	34
Lorain	31, 34
McGuffey	34
Mineral Point	35
Newark	35
New Bavaria	35
New Berlin	35
Niles	23
Plain City	22
Springfield	21, 31
Summary of	6
Wauseon	31
Waverly	35
South Brooklyn, sewerage for.....	27, 42, 158
South Charleston	525
Discussion	471-475
Results of examination.....	420
Samples from	400-410
Sampling station	398
Solids, total —	
Discussion	474, 478, 487
Plates	445, 456, 467
Springfield	509
Analysis of water supply of.....	211
Discussion	479
Map of	392
Results of examination.....	426, 428
Samples from	400-410
Sampling stations	399
Sewerage of	528
Smallpox at	21, 31
Water supply of.....	39, 101, 558
Spring Valley	523
State Board of Health —	
Members of	4
Meetings of	5, 16, 26, 39

	PAGE
Stillwater River	512, 513
Discussion of examination of.....	476
Plates	448-458
Rainfall	413
Samples from	400
Sampling stations on.....	398
Summary	479
Table of results of examination.....	424
Stone Lick Creek.....	519
Stony Creek	516
Storm Creek	511
Stream gaging	571
Maumee River	581
Olentangy River	571
Sandusky River	578
Scioto River	571
Sugar Creek	523
Summary of pollution of Miami watersheds.....	535
Summary of public water supplies of Miami watersheds.....	564
Symmes Corners	503
Table 1. Area of watersheds.....	494
2. Approximate gradient of principal streams.....	497
3. Population on watersheds.....	500
4. Sewerage of cities and villages having public water supplies.....	525
5. Sewerage of isolated public institutions.....	530
6. Urban population in relation to watershed area.....	538
7. Classification of public water supplies.....	545
8. Summary of data of public water supplies of Miami watersheds.....	564
9. Water rates	566
10. Water power of Great Miami watershed.....	569
11. Water power of Little Miami watershed.....	569
12. Rainfall of Scioto and Olentangy watersheds.....	573
13. Monthly discharge of Olentangy River at Columbus.....	574
14. Monthly discharge of Scioto River at Columbus.....	575
15. Rainfall on Sandusky watershed.....	578
16. Monthly discharge of Sandusky River at Mexico.....	578
17. Rainfall on Maumee watershed.....	581
18. Monthly discharge of Maumee River at Waterville.....	582
Taylor's Creek	502
Tiffin, analysis of water supply of.....	212
Tippecanoe City	514
Sewerage of	528
Water supply of.....	559
The Western, sewerage and water supply of.....	532
Todds Fork	521
Toledo —	
Sewerage for	16, 17, 20, 26, 40, 160
Extension of water mains at.....	17
Trebeins	523
Trotwood	508
Water supply	559
Troy	514
Map of	386

Troy — Concluded.	PAGE
Results of examinations.....	430
Samples from	400-410
Sampling stations	399
Sewerage of	528
Water supply of.....	19, 560
Tuberculosis in animals, lectures on.....	25
Turbidity (see physical properties).	
Turtle Creek	521
Twin Creek	505
Typhoid fever—	
Investigation of, at Mingo Junction.....	47
Report of an outbreak of, at Union Furnace.....	52
Urban populations in relation to watershed areas.....	538
Urbana	511
Discussion	479
Map of	391
Results of examinations.....	426
Samples from	400-410
Sampling stations	398
Sewerage of	528
Water supply of.....	561
Union Furnace, report of an outbreak of typhoid fever at.....	52
Versailles	513
Water supply for.....	29, 40, 45, 102, 561
Wapakoneta, investigation of a nuisance at.....	179
Warren, sewerage of.....	37, 160
Warren County Children's Home.....	521
Warren County Infirmary.....	521
Water, analysis of miscellaneous samples of.....	214
Water power of Great Miami watershed.....	569
Of Little Miami watershed.....	569
Water rates	566
Watershed map of Great and Little Miami rivers.....	380
Water supply —	
For Batavia	26, 28, 57, 547
Bellefontaine	549
Bellevue	29, 44, 59, 195
Blanchester	549
Bucyrus	26, 60
Cambridge	17, 41
Canton	29, 195
Columbus	196
Conneaut	19, 64
Cuyahoga Falls	45, 65
Dayton	27, 67, 208, 550
Dennison	68
Eaton	551
Fort Recovery	44, 75
Franklin	551
Galion	22, 78
Geneva	39, 40
Glouster	83
Greenville	19, 552

Water supply — Concluded.	PAGE
Hamilton	552
Lebanon	553
Leetonia	87
Leipsic	45, 89
Lorain	41
Lynchburg	41, 91, 553
McConnellsville	19, 93
Madisonville	554
Middletown	209, 555
Mingo Junction	29, 44, 210
Norwood	556
Ohio Hospital for Epileptics.....	27, 85
Osborn	556
Oxford	210, 557
Painesville	45, 94
Piqua	16, 17, 20, 95, 557
Sebring	20, 99
Shreve	211
Sidney	558
Springfield	39, 101, 211, 558
Tiffin	212
Tippecanoe City	559
Trotwood	559
Troy	19, 560
Urbana	561
Versailles	29, 40, 45, 102, 561
Wauseon	212
Waynesville	41, 107, 562
West Alexandria	213, 562
West Carrollton	562
Wooster	24
Xenia	563
Zanesville	20, 39, 40, 41, 109
Water supplies	11
Notes on, of isolated public institutions.....	530
of the Miami watersheds, summary of.....	564
water rates of	566
Wauseon —	
Analysis of water supply of.....	212
Smallpox at	31
Waverly —	
Smallpox at	35
Waynesville	522
Water supply for.....	41, 107, 562
West Alexandria	505
Analysis of water supply of.....	213
Sewerage of	528
Water supply of.....	562
West Carrollton	506
Sewerage of	528
Water supply of.....	562
Wilberforce College	524
Sewerage and water supply of.....	532

	PAGE
Williamsburg	520
Wilmington	522
Wolf Creek	508, 517
Wooster, water supply of.....	24
Xenia	523
Discussion	471-476
Investigation of court house at.....	36
Map of	393
Results of examinations.....	420
Samples from	400-410
Sampling stations	398
Sewage disposal for.....	26, 28, 42, 163
Sewerage of	528
Water supply of	563
Xenia township, Greene county, investigation of a nuisance in.....	182
Yellow Springs	525
Zanesville—	
Sewerage for	18, 19
Water supply for.....	20, 39, 40, 41, 109



COLUMBIA UNIVERSITY LIBRARIES

This book is due on the date indicated below, or at the expiration of a definite period after the date of borrowing, as provided by the rules of the Library or by special arrangement with the Librarian in charge.

[illegible]

